INSTALLATION INSTRUCTIONS

A97USMV

Warm Air Gas Furnace

Upflow/Horizontal Left and Right Air Discharge

This manual must be left with the homeowner for future reference.

This is a safety alert symbol and should never be ignored. When you see this symbol on labels or in manuals, be alert to the potential for personal injury or death.

⚠ CAUTION

As with any mechanical equipment, personal injury can result from contact with sharp sheet metal edges. Be careful when you handle this equipment.

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional installer (or equivalent), service agency or the gas supplier.

NOTICE

A thermostat is not included and must be ordered separately.

- A Comfort Sync™ thermostat must be used in communicating applications.
- In non-communicating applications, a traditional non-communication thermostat may be used.

In all cases, setup is critical to ensure proper system operation.

Field wiring for both communicating and non-communicating applications is illustrated in these instructions.

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* P 5 0 6 8 8 7 - 0 1 *

(P) 506887-01

Manufactured By
Allied Air Enterprises, Inc.
A Lennox International, Inc. Company
215 Metropolitan Drive
West Columbia, SC 29170

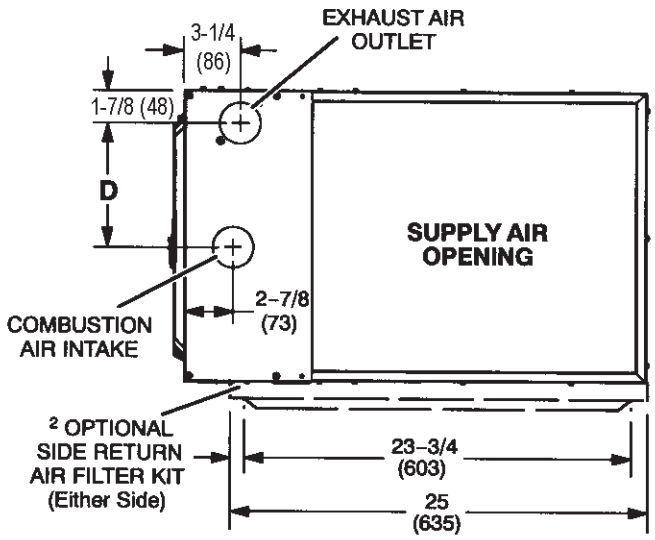
Unit Dimensions - inches (mm)

*** NOTE** - C/D20 size units that require second stage air volumes over 1800 cfm (850 L/S) must have one of the following:

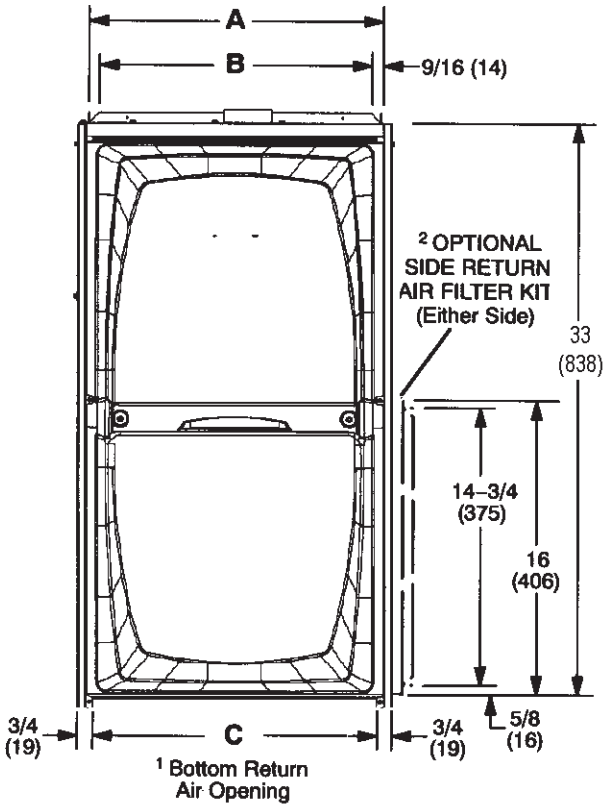
1. Single side return air with transition, to accommodate 20 x 25 x 1 in. (508 x 635 x 25 mm) air filter.
2. Single side return air with optional RAB Return Air Base
3. Bottom return air.
4. Return air from both sides.
5. Bottom **and** one side return air.

See Blower Performance Tables for additional information.

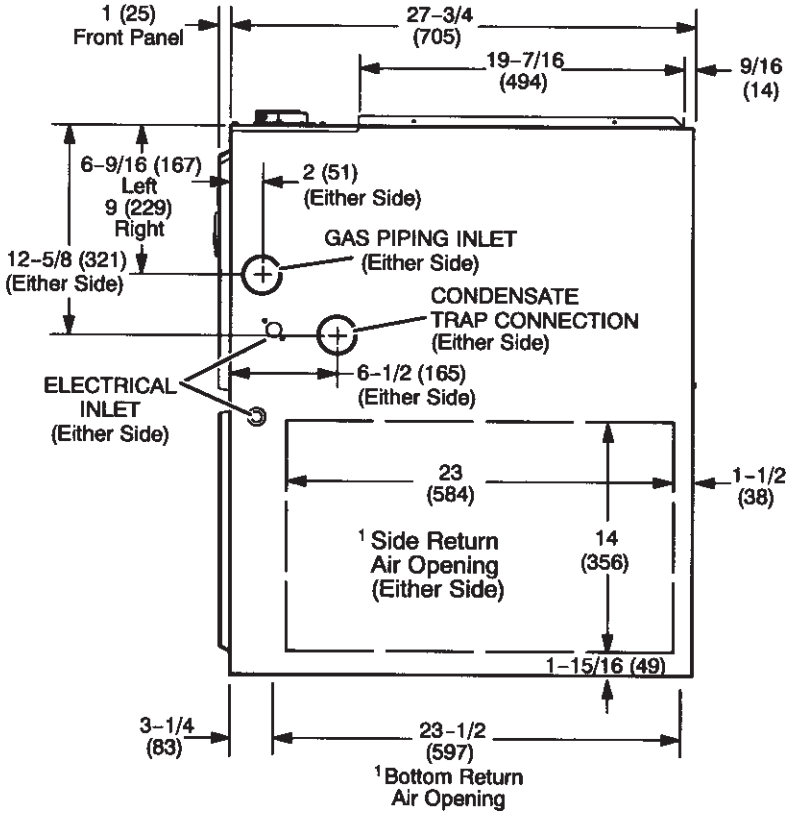
* Optional External Side Return Air Filter Kit is not for use with the optional RAB Return Air Base.



TOP VIEW



FRONT VIEW



SIDE VIEW

Model Number	A		B		C		D	
	in.	mm	in.	mm	in.	mm	in.	mm
A97USMV070B12S	17-1/2	446	16-3/8	416	16	406	7-5/8	194
A97USMV090C12S A97USMV090C16S A97USMV090C20S A97USMV110C20S	21	533	19-7/8	505	19-1/2	495	9-3/8	238
A97USMV135D20S	24-1/2	622	23-3/8	594	23	584	11-1/8	283

A97USMV Exploded View

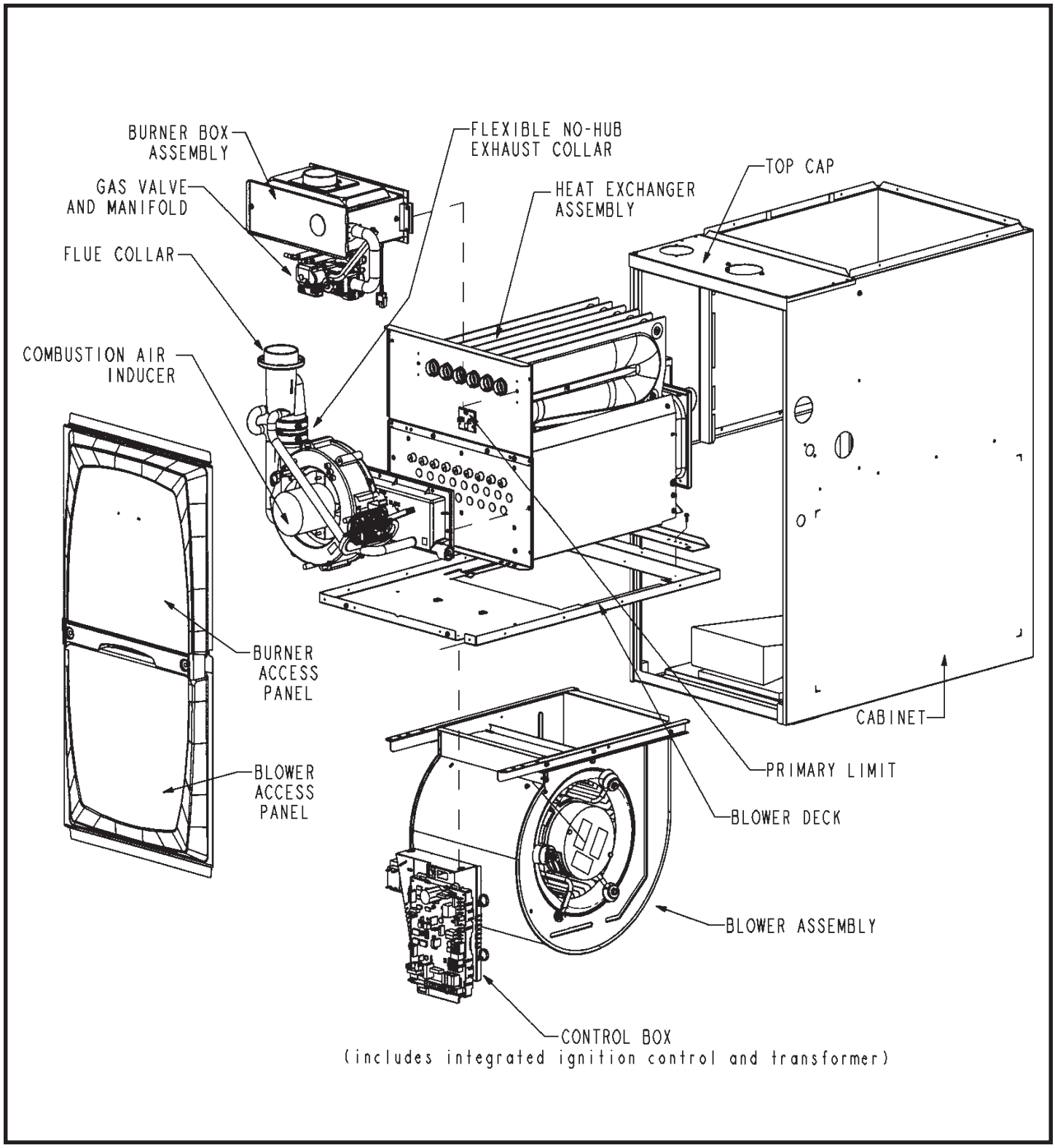


Figure 1

A97USMV Gas Furnace
The A97USMV Category IV gas furnace is equipped with a variable capacity, variable speed integrated control. Each A97USMV is shipped ready for installation in the upflow, horizontal left air discharge or horizontal right air discharge position.

The furnace is equipped for installation in natural gas applications only. A change over kit must be ordered for LP/ propane applications.

The A97USMV must be installed only as a Direct Vent gas central furnace

NOTE: *In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged outdoors. See Figure 2 for applications including roof termination.*

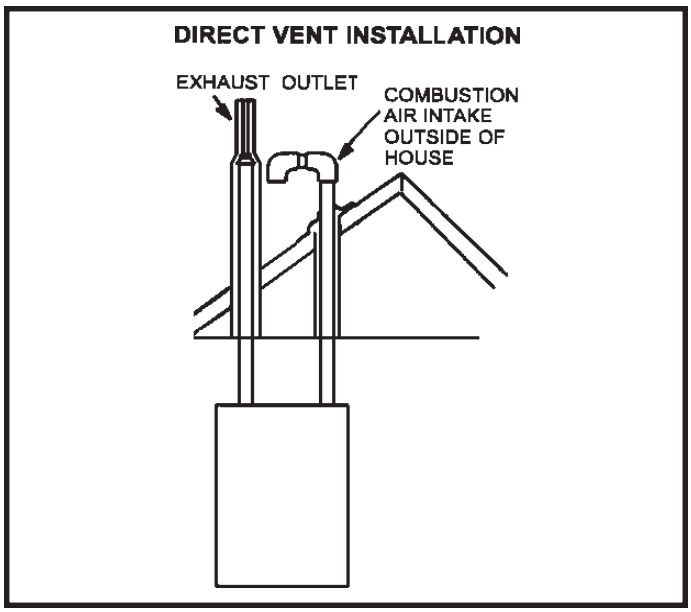


Figure 2

Shipping and Packing List
1 - Assembled A97USMV unit.
1 - Bag assembly containing the following:
- 1 - Snap bushing
- 1 - Snap Plug
- 1 - Wire tie
- 1 - Condensate trap
- 1 - Condensate trap cap
- 1 - Condensate trap cap clamp
- 1 - 1/2” Threaded PVC street elbow

Check equipment for shipping damage. If you find any damage, immediately contact the last carrier.

Please refer to specification sheets for available accessories.

Safety Information

DANGER

DANGER OF EXPLOSION!

There are circumstances in which odorant used with LP/ Propane gas can lose its scent. In case of a leak, LP/ Propane gas will settle close to the floor and may be difficult to smell. An LP/Propane leak detector should be installed in all LP applications.

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional installer (or equivalent), service agency or the gas supplier.

CAUTION

As with any mechanical equipment, personal injury can result from contact with sharp sheet metal edges. Be careful when you handle this equipment.

Use only the type of gas approved for use with this furnace. Refer to unit nameplate.

Building Codes
In the USA, installation of gas furnaces must conform with local building codes. In the absence of local codes, units must be installed according to the current National Fuel Gas Code (ANSI Z223.1/NFPA 54). The National Fuel Gas Code is available from the **American National Standards Institute, Inc., 11 West 42nd Street, New York, NY 10036**.

Installed Locations
In Canada, installation must conform with current National Standard of Canada CSA-B149 Natural Gas and Propane Installation Codes, local plumbing or waste water codes and other applicable local codes.

The furnace is designed for installation clearances to combustible material as listed on the unit nameplate and in the tables in Figures 10 and 11. Accessibility and service clearances must take precedence over fire protection clearances.

NOTE: *For installation on combustible floors, the furnace shall not be installed directly on carpeting, tile, or other combustible material other than wood flooring.*

For installation in a residential garage, the furnace must be installed so that the burner(s) and the ignition source are located no less than 18 inches (457 mm) above the floor. The furnace must be located or protected to avoid physical damage by vehicles. When a furnace is installed in a public garage, hangar, or other building that has a hazardous atmosphere, the furnace must be installed according to recommended good practice requirements and current National Fuel Gas Code or CSA B149 standards.

Note: *Furnace must be adjusted to obtain a temperature rise (100% percent capacity) within the range (s) specified on the unit nameplate. Failure to do so may cause erratic limit operation and may also result in premature heat exchanger failure.*

This furnace must be installed so that its electrical components are protected from water.

Installed in Combination with a Cooling Coil
When this furnace is used with cooling units, it shall be installed in parallel with, or on the upstream side of, cooling units to avoid condensation in the heating compartment. With a parallel flow arrangement, a damper (or other means to control the flow of air) must adequately prevent chilled air from entering the furnace. If the damper is manually operated, it must be equipped to prevent operation of either the heating or the cooling unit, unless it is in the full **HEAT** or **COOL** setting. See Figure 3.

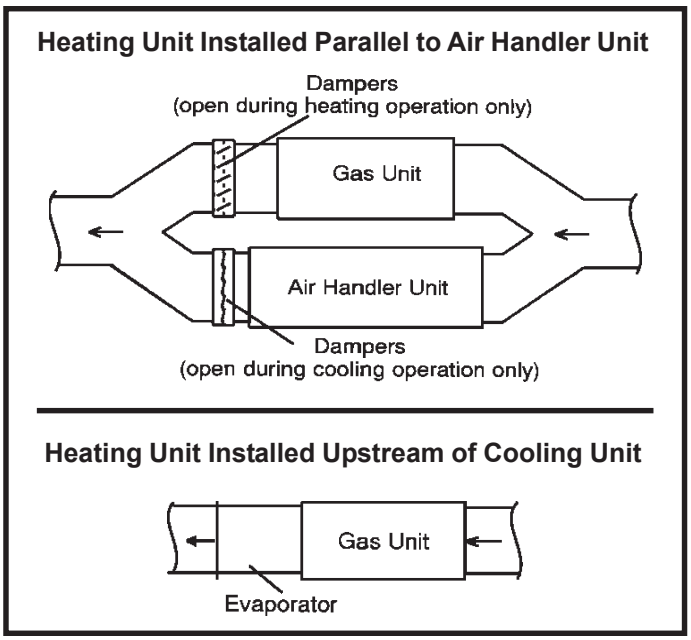


Figure 3

When installed, this furnace must be electrically grounded according to local codes. In addition, in the United States, installation must conform with the current National Electric Code, ANSI/NFPA No. 70. The National Electric Code (ANSI/NFPA No. 70) is available from the following address:

National Fire Protection Association
1 Battery March Park
Quincy, MA 02269

NOTE: *This furnace is designed for a minimum continuous return air temperature of 60°F (16°C) or an intermitent operation down to 55°F (13°C) dry blub for cases where a night setback thermostat is used. Return air temperature must not exceed 85°F (29°C)dry bulb.*

In Canada, all electrical wiring and grounding for the unit must be installed according to the current regulations of the Canadian Electrical Code Part I (CSA Standard C22.1) and/or local codes.

⚠ CAUTION

Do Not set thermostat below 60° F (16° C) in heating mode. Setting thermostat below 60° F (16° C) reduces the number of heating cycles. Damage to the unit may occur that is not covered by the warranty.

The A97USMV furnace may be installed in alcoves, closets, attics, basements, garages, crawl spaces and utility rooms.

This furnace design has not been CSA Certified for installation in mobile homes, recreational vehicles, or outdoors.

Use of Furnace as Construction Heater
These units are not recommended for use as a construction heater during any phase of construction. Very low return air temperature, harmful vapors and operation of the unit with clogged or misplaced filters will damage the unit.

These units may be used for heating of buildings or structures under construction, if the following conditions are met:

- The vent system must be permanently installed per these installation instructions.
- A room thermostat must control the furnace. The use of fixed jumpers that will provide continuous heating is not allowed.
- The return air duct must be provided and sealed to the furnace.
- Return air temperature range between 60°F (16°C) and 80°F (27°C) must be maintained.
- Air filters must be installed in the system and must be maintained during construction.

- Air filters must be replaced upon construction completion.
- The input rate and temperature rise must be set per the furnace rating plate.
- One hundred percent (100%) outdoor air must be provided for combustion air requirements during construction.
- The furnace heat exchanger, components, duct system, air filters and evaporator coils must be thoroughly cleaned following final construction cleanup.
- All furnace operating conditions (including ignition, input rate, temperature rise and venting) must be verified according to these installation instructions.

General

⚠ WARNING

Product Contains Fiberglass Wool.

Disturbing the insulation in this product during installation, maintenance, or repair will expose you to fiberglass wool. Breathing this may cause lung cancer. (Fiberglass wool is known to the State of California to cause cancer.)
Fiberglass wool may also cause respiratory, skin, and eye irritation.
To reduce exposure to this substance or for further information, consult material safety data sheets available from address shown below, or contact your supervisor.

Allied Air Enterprises, Inc.
215 Metropolitan Drive
West Columbia, SC 29170

⚠ CAUTION

These units should not be installed in areas normally subject to freezing temperatures.

These instructions are intended as a general guide and do not supersede local codes in any way. Consult authorities having jurisdiction before installation.

In addition to the requirements outlined previously, the following general recommendations should be considered when installing one of these furnaces:

- Place the furnace as close to the center of the air distribution system as possible. The furnace should also be located close to the vent termination point.
- When the furnace is installed in an attic or other insulated space, keep insulation away from the furnace.
- When the furnace is installed in an unconditioned space, consider provisions required to prevent freezing of condensate drain system.

Installation – Setting Equipment

⚠ WARNING

Do not install the furnace on its front or its back. See Figure 4.

⚠ WARNING

Do not connect the return air ducts to the back of the furnace. Doing so will adversely affect the operation of the safety control devices, which could result in personal injury or death.

Upflow Applications
This gas furnace can be installed as shipped in the upflow position. Refer to Figure 10 for clearances.

Select a location that allows for the required clearances that are listed on the unit nameplate. Also consider gas supply connections, electrical supply, vent connection, condensate trap and drain connections, and installation and service clearances (24 inches [610 mm] at unit front). The unit must be level from side to side, for proper operation. *It is recommended to tilt the unit slightly toward the drain to insure proper drainage. See Figure 5.*

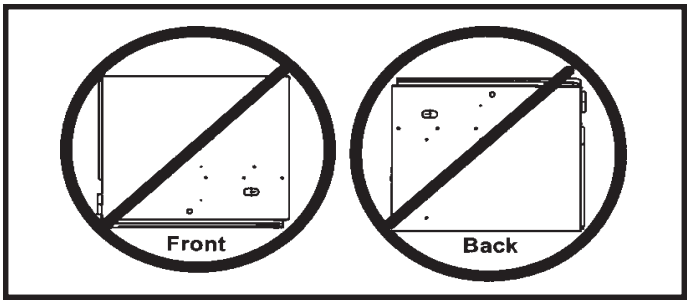
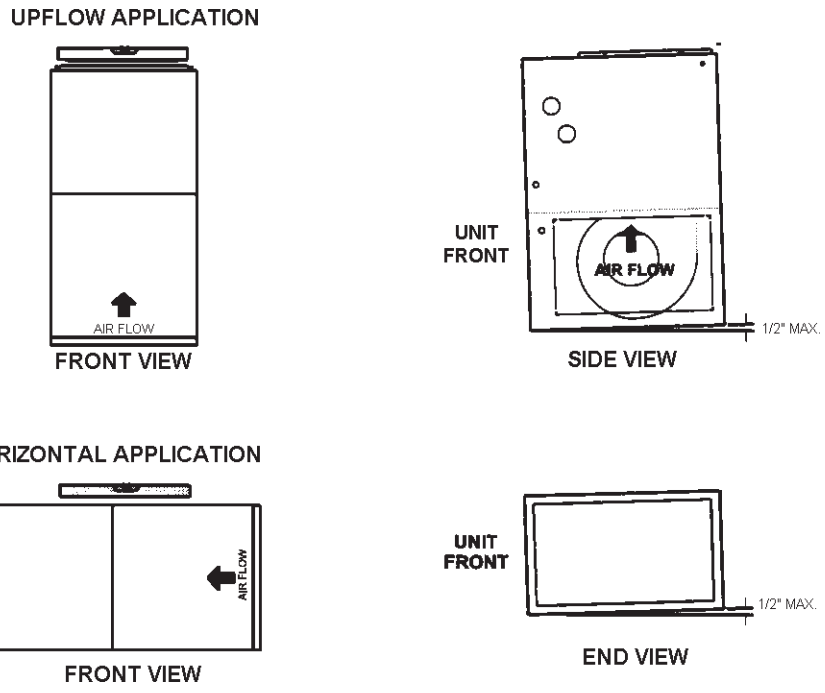


Figure 4

SETTING EQUIPMENT

UNIT MUST BE LEVEL SIDE TO SIDE IN ALL APPLICATIONS FOR PROPER OPERATION.
A SLIGHT TILT TOWARD THE DRAIN IS RECOMMENDED FOR PROPER DRAINAGE.



TILT THE UNIT SLIGHTLY (MAX. 1/2") FROM BACK TO FRONT TO AID IN THE DRAINING OF THE HEAT EXCHANGER.

Figure 5

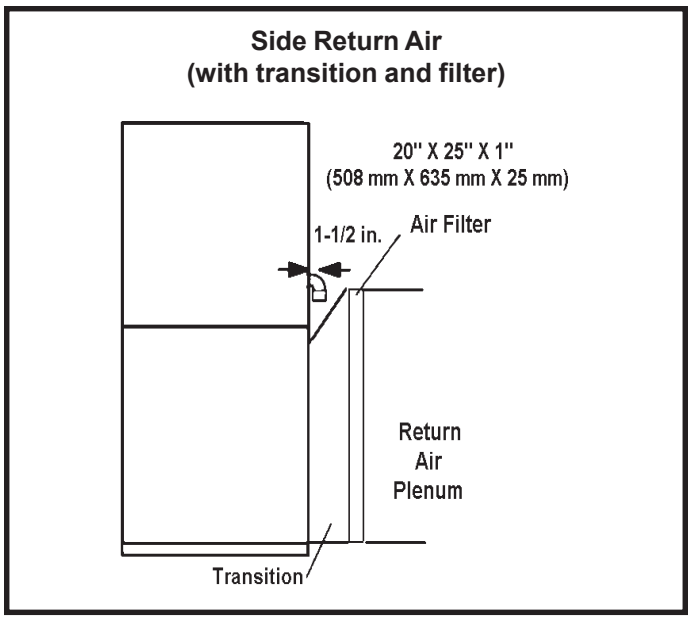


Figure 6

A97USMV applications which include side return air and a condensate trap installed on the same side of the cabinet (trap can be installed remotely within 5 feet) require either a return air base or field fabricated transition to accommodate an optional IAQ accessory taller than 14.5". See Figure 6.

Removing the Bottom Panel

Remove the two screws that secure the bottom cap to the furnace. Pivot the bottom cap down to release the bottom panel. Once the bottom panel has been removed, reinstall the bottom cap. See Figure 7.

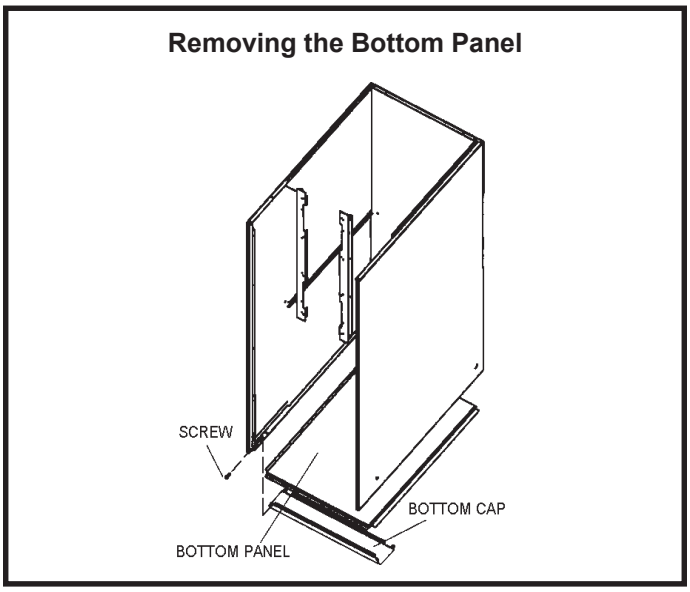
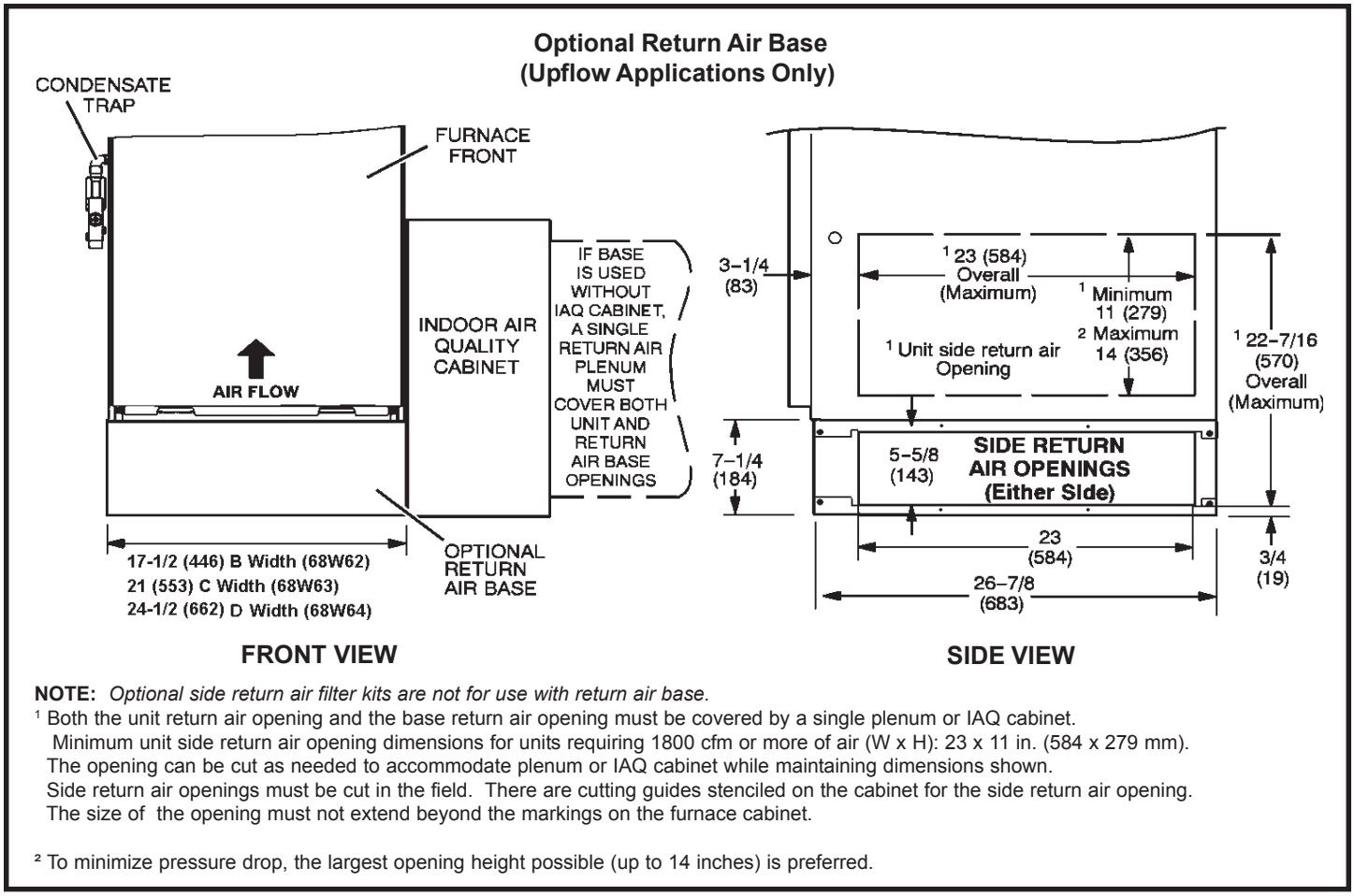


Figure 7



NOTE: *Optional side return air filter kits are not for use with return air base.*

[1] Both the unit return air opening and the base return air opening must be covered by a single plenum or IAQ cabinet. Minimum unit side return air opening dimensions for units requiring 1800 cfm or more of air (W x H): 23 x 11 in. (584 x 279 mm). The opening can be cut as needed to accommodate plenum or IAQ cabinet while maintaining dimensions shown. Side return air openings must be cut in the field. There are cutting guides stenciled on the cabinet for the side return air opening. The size of the opening must not extend beyond the markings on the furnace cabinet.

[2] To minimize pressure drop, the largest opening height possible (up to 14 inches) is preferred.

Figure 8

NOTE: *Units with 1/2 hp blower motor are equipped with three flexible legs and one rigid leg. The rigid leg is equipped with a shipping bolt and a flat white plastic washer (rather than the rubber mounting grommet used with a flexible mounting leg).* See Figure 9. **The bolt and washer must be removed before the furnace is placed into operation.** After the bolt and washer have been removed, the rigid leg will not touch the blower housing.

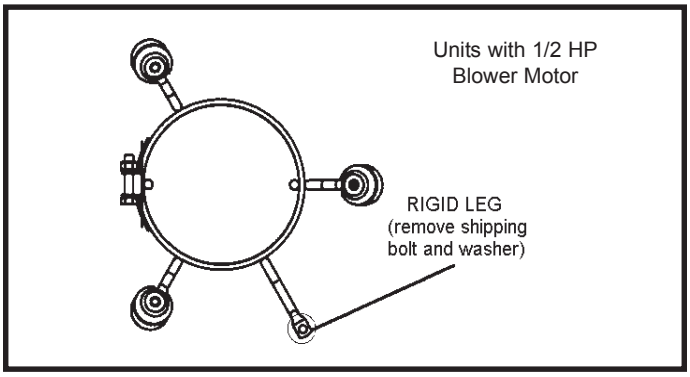


Figure 9

Allow for clearances to combustible materials as indicated on the unit nameplate. Minimum clearances for closet or alcove installations are shown in Figure 10.

⚠ WARNING

Blower access panel must be securely in place when blower and burners are operating. Gas fumes, which could contain carbon monoxide, can be drawn into living space resulting in personal injury or death.

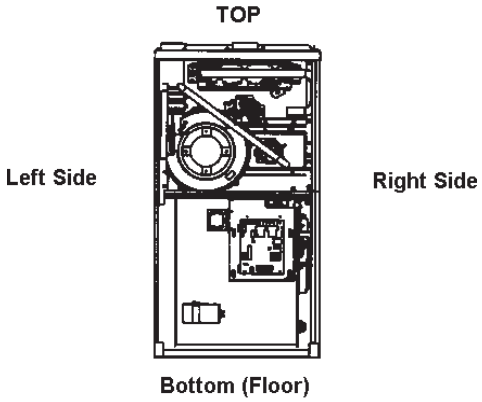
⚠ WARNING

Improper installation of the furnace can result in personal injury or death. Combustion and flue products must never be allowed to enter the return air system or air in the living space. Use sheet metal screws and joint tape to seal return air system to furnace.

In platform installations with furnace return, the furnace should be sealed airtight to the return air plenum. A door must never be used as a portion of the return air duct system. The base must provide a stable support and an airtight seal to the furnace. Allow absolutely no sagging, cracks, gaps, etc.

For no reason should return and supply air duct systems ever be connected to or from other heating devices such as a fireplace or stove, etc. Fire, explosion, carbon monoxide poisoning, personal injury and/or property damage could result.

Installation Clearances



Top/Plenum	1 in. (25 mm)
* Front	0
Back	0
Sides	0†
Vent	0
Floor	0‡

* Front clearance in alcove installation must be 24 in. (610 mm). Maintain a minimum of 24 in. (610 mm) for front service access.
† Allow proper clearances to accommodate condensate trap installation.
‡ For installations on a combustible floor, do not install the furnace directly on carpeting, tile or other combustible materials other than wood flooring.

Figure 10

Return Air – Upflow Units

Return air can be brought in through the bottom or either side of the furnace installed in an upflow application. If the furnace is installed on a platform with bottom return, make an airtight seal between the bottom of the furnace and the platform to ensure that the furnace operates properly and safely. The furnace is equipped with a removable bottom panel to facilitate installation.

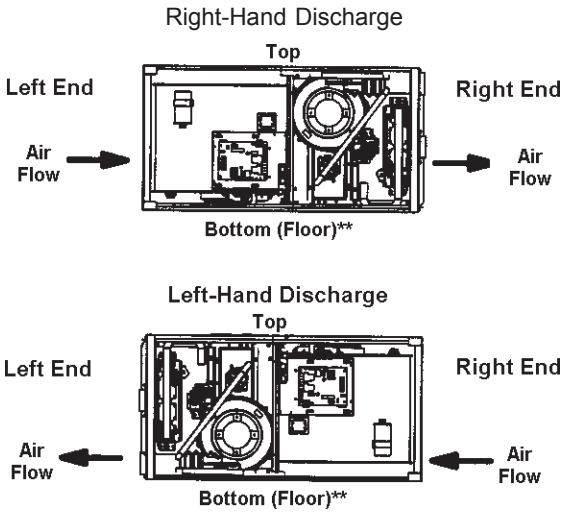
Markings are provided on both sides of the furnace cabinet for installations that require side return air. Cut the furnace cabinet at the maximum dimensions shown on page 2.

Setting and Upflow Unit
When the side return air inlets are used in an upflow application, it may be necessary to install shims on the bottom of the furnace.

Horizontal Applications
The A97USMV furnace can be installed in horizontal applications with either right or left hand air discharge.

Refer to Figure 11 for clearances in horizontal applications.

Horizontal Application Installation Clearances



Top	0
* Front	0
Back	0
Ends	0
Vent	0
Floor	0‡

* Front clearance in alcove installation must be 24 in. (610 mm). Maintain a minimum of 24 in. (610 mm) for front service access.
** An 8" service clearance must be maintained below the unit to provide for servicing of the condensate trap. Unless the trap is mounted remotely.
‡ For installations on a combustible floor, do not install the furnace directly on carpeting, tile or other combustible materials other than wood flooring.

Figure 11

Suspended Installation of Horizontal Unit
This furnace may be installed in either an attic or a crawlspace. Either suspend the furnace from roof rafters or floor joists, as shown in Figure 12 or install the furnace on a platform, as shown in Figure 13. A horizontal suspension kit (51W10) may be ordered or use equivalent.

NOTE: *Heavy gauge sheet metal straps may be used to suspend the unit from roof rafters or ceiling joists. When straps are used to suspend the unit in this way, support must be provided for both the ends. The straps must not interfere with the plenum or exhaust piping installation.* ***Cooling coils and supply and return air plenums must be supported separately.***

NOTE: *When the furnace is installed on a platform in a crawlspace, it must be elevated enough to avoid water damage and to allow the evaporator coil to drain.*

Typical Horizontal Application

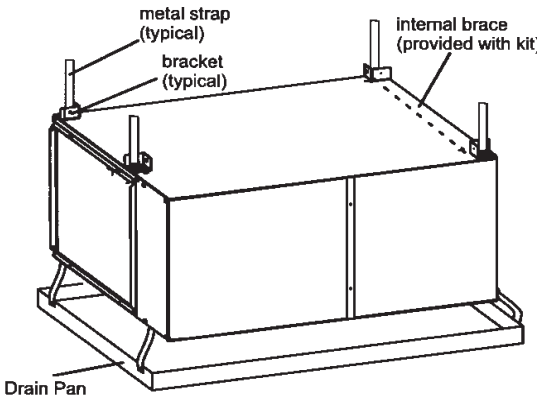
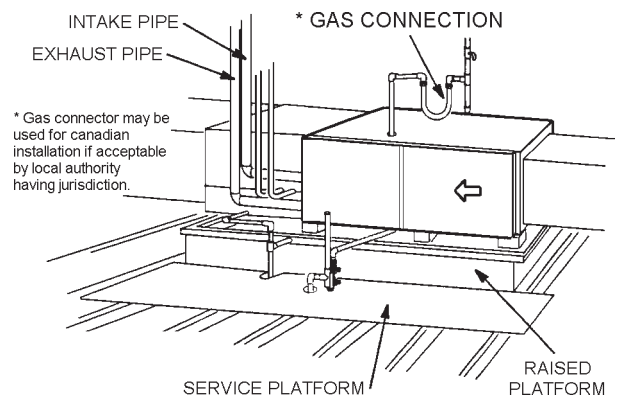


Figure 12

Platform Installation of Horizontal Unit
1. Select location for unit keeping in mind service and other necessary clearances. See Figure 11.
2. Construct a raised wooden frame and cover frame with a plywood sheet. If unit is installed above finished space, fabricate an auxiliary drain pan to be installed under unit. Set unit in drain pan as shown in Figure 13. Leave 8 inches for service clearance below unit for condensate trap, unless trap is installed remotely.
3. Provide a service platform in front of unit. When installing the unit in a crawl space, a proper support platform may be created using cement blocks.
4. Route auxiliary drain line so that water draining from this outlet will be easily noticed by the homeowner.
5. If necessary, run the condensate line into a condensate pump to meet drain line slope requirements. The pump must be rated for use with condensing furnaces. Protect the condensate discharge line from the pump to the outside to avoid freezing.
6. Continue with exhaust, condensate and intake piping installation according to instructions.


INTAKE PIPE
EXHAUST PIPE
* GAS CONNECTION
* Gas connector may be used for canadian installation if acceptable by local authority having jurisdiction.
SERVICE PLATFORM
RAISED PLATFORM

* Gas Connector may be used for Canadian installation if acceptable by local authority having jurisdiction.

Figure 13

Return Air - Horizontal Applications
Return air must be brought in through the end of a furnace installed in the horizontal position. The furnace is equipped with a removable bottom panel to facilitate installation. See Figure 7.

Filters
This unit is not equipped with a filter or rack. A field provided filter is required for the unit to operate properly. Table 1 lists recommended filter sizes.

A filter must be in place when the unit is operating!

NOTE: *In upflow applications where side return air filter is installed on same side as the condensate trap, make sure that clearance is maintained to ensure future access to the filter access panel.*

Furnace Cabinet Width	Minimum Filter Size	
	Side Return	Bottom Return
17-1/2"	16 X 25 X 1 (1)	16 X 25 X 1 (1)
21"	16 X 25 X 1 (1)	20 X 25 X 1 (1)
24-1/2"	16 X 25 X 1 (1)	24 X 25 X 1 (1)

Table 1

Duct System
Use industry approved standards to size and install the supply and return air duct system. This will result in a quiet and low static system that has uniform air distribution.

NOTE: *Operation of this furnace in heating mode (indoor blower operating at selected heating speed) with an external static pressure which exceeds 0.8 inches w.c. may result in erratic limit operation.*

Supply Air Plenum
If the furnace is installed without a cooling coil, a removable access panel should be installed in the supply air duct. The access panel should be large enough to permit inspection (by reflected light) of the heat exchanger for leaks after the furnace is installed. If present, this access panel must always be in place when the furnace is operating and it must not allow leaks into or from the supply air duct system.

Return Air Plenum
Return air must not be drawn from a room where this furnace, or any other gas fueled appliance (i.e., water heater), or carbon monoxide producing device (i.e., wood fireplace) is installed. When return air is drawn from a room, a negative pressure is created in the room. If a gas appliance is operating in a room with negative pressure, the flue products can be pulled back down the vent pipe and into the room. This reverse flow of the flue gas may result in incomplete combustion and the formation of carbon monoxide gas. This toxic gas might then be distributed throughout the house by the furnace duct system.

Return air can be brought in through the bottom or either side of the furnace. If a furnace with bottom return air is installed on a platform, make an airtight seal between the bottom of the furnace and the platform to ensure that the unit operates properly and safely. Use fiberglass sealing strips, caulking, or equivalent sealing method between the plenum and the furnace cabinet to ensure a tight seal. If a filter is installed, size the return air duct to fit the filter frame.

Pipe and Fittings Specifications

All pipe, fittings, primer and solvent cement must conform with American National Standard Institute and the American Society for Testing and Materials (ANSI/ASTM) standards. The solvent shall be free flowing and contain no lumps, undissolved particles or any foreign matter that adversely affects the joint strength or chemical resistance of the cement. The cement shall show no gelation, stratification, or separation that cannot be removed by stirring. Refer to Table 2 for approved piping and fitting materials.

PIPING AND FITTINGS SPECIFICATIONS

Schedule 40 PVC (Pipe)	D1785
Schedule 40 PVC (Cellular Core Pipe)	F891
Schedule 40 PVC (Fittings)	D2466
Schedule 40 CPVC (Pipe)	F441
Schedule 40 CPVC (Fittings)	F438
SDR-21 PVC or SDR-26 PVC (Pipe)	D2241
SDR-21 CPVC or SDR-26 CPVC (Pipe)	F442
Schedule 40 ABS Cellular Core DWV (Pipe)	F628
Schedule 40 ABS (Pipe)	D1527
Schedule 40 ABS (Fittings)	D2468
ABS-DWV (Drain Waste & Vent) (Pipe & Fittings)	D2661
PVC-DWV (Drain Waste & Vent) Pipe & Fittings)	D2665
PRIMER & SOLVENT CEMENT	**ASTM SPECIFICATION**
PVC & CPVC Primer	F656
PVC Solvent Cement	D2564
CPVC Solvent Cement	F493
ABS Solvent Cement	D2235
PVC/CPVC/ABS All Purpose Cement For Fittings & Pipe of the same material	D2564, D2235, F493
ABS to PVC or CPVC Transition Solvent Cement	D3138
CANADA PIPE & FITTING & SOLVENT CEMENT	**MARKING**
PVC & CPVC Pipe and Fittings	ULCS636
PVC & CPVC Solvent Cement	
ABS to PVC or CPVC Transition Cement	

Table 2

⚠ CAUTION

Solvent cements for plastic pipe are flammable liquids and should be kept away from all sources of ignition. Do not use excessive amounts of solvent cement when making joints. Good ventilation should be maintained to reduce fire hazard and to minimize breathing of solvent vapors. Avoid contact of cement with skin and eyes.

⚠ IMPORTANT

The exhaust and intake connections are made of PVC. Use PVC primer and solvent cement when using PVC vent pipe. When using ABS vent pipe, use transitional solvent cement to make connections to the PVC fittings in the unit.

Use PVC primer and solvent cement or ABS solvent cement meeting ASTM specifications, refer to Table 2. As an alternate, use all purpose cement, to bond ABS, PVC, or CPVC pipe when using fittings and pipe made of the same materials. Use transition solvent cement when bonding ABS to either PVC or CPVC.

Low temperature solvent cement is recommended. Metal or plastic strapping may be used for vent pipe hangers. Uniformly apply a liberal coat of PVC primer for PVC.

Canadian Applications Only – *Pipe, fittings, primer and solvent cement used to vent (exhaust) this applicance must be certified to ULCS636 and supplied by a single manufacturer as part of an approved vent (exhaust) system. In addition, the first three feet of vent pipe from the furnace flue collar must be accessible for inspection.*

Table 3 lists the available exhaust termination kits, as well as vent pipe equivalencies which must be used when sizing vent pipe.

OUTDOOR TERMINATION KITS USAGE

A97USMV	VENT PIPE DIA. (in.)	STANDARD			CONCENTRIC		
		Outdoor Exhaust Accelerator (Dia. X Length)	Outdoor Exhaust Accelerator (Dia. X Length)	Flush Mount Kit	1-1/2" Concentric Kit	2" Concentric Kit	3" Concentric Kit
		1-1/2" X 12"	2" X 12"	51W11 *	71M80 or †44W92††	69M29 or †44W92††	60L46 or 44W93†
070	2	YES		YES	YES		
	2-1/2	YES		YES	YES		
	3	YES		YES	YES		
090	2		YES	YES		YES	YES
	2-1/2		YES	YES		YES	YES
	3		YES	YES		YES	YES
110	2		YES	YES		YES	YES
	2-1/2		YES	YES		YES	YES
	3		YES	YES		YES	YES
135	3		YES	YES			YES

** Kit 51W11 is provided with a 1-1/2" accelerator which must be used for all 2 and 2-1/2" PVC installations.*
† Termination kits 44W92 and 44W93 are approved for use in Canadian installations to meet CSAB149.
†† The 44W92 Concentric kit is provided with a 1-1/2" accelerator which must be installed on the exhaust outlet when this kit is used with this furnace.

Table 3

Joint Cementing Procedure
All cementing of joints should be done according to the specifications outlined in ASTM D2855.

⚠ DANGER

DANGER OF EXPLOSION!

Fumes from PVC glue may ignite during system check. Allow fumes to dissipate for at least 5 minutes before placing unit into operation.

1. Measure and cut vent pipe to desired length.
2. Debur and chamfer end of pipe, removing any ridges or rough edges. If end is not chamfered, edge of pipe may remove cement from fitting socket and result in a leaking joint.
3. Clean and dry surfaces to be joined.
4. Test fit joint and mark depth of fitting on outside of pipe.
5. Uniformly apply a liberal coat of PVC primer for PVC or use a clean dry cloth for ABS to clean inside socket surface of fitting and male end of pipe to depth of fitting socket.
6. Promptly apply solvent cement to end of pipe and inside socket surface of fitting. Cement should be applied lightly but uniformly to inside of socket. Take care to keep excess cement out of socket. Apply second coat to end of pipe.

NOTE: *Time is critical at this stage. Do not allow primer to dry before applying cement.*

7. Immediately after applying last coat of cement to pipe, and while both inside socket surface and end of pipe are wet with cement, forcefully insert end of pipe into socket until it bottoms out. Turn PVC pipe 1/4 turn during assembly (but not after pipe is fully inserted) to distribute cement evenly. **DO NOT** turn ABS or cellular core pipe.

NOTE: *Assembly should be completed within 20 seconds after last application of cement. Hammer blows should not be used when inserting pipe.*

8. After assembly, wipe excess cement from pipe at end of fitting socket. A properly made joint will show a bead around its entire preimeter. Any gaps may indicate a defective asembly due to insufficient solvent.
9. Handle joints carefully until completely set.

Venting Practices

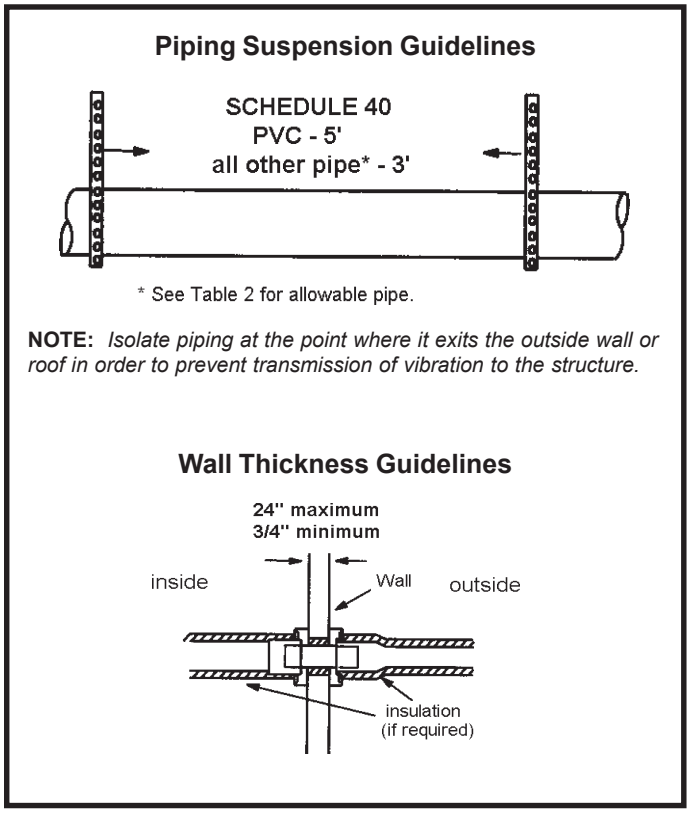

Piping Suspension Guidelines
SCHEDULE 40
PVC - 5'
all other pipe* - 3'
* See Table 2 for allowable pipe.
NOTE: Isolate piping at the point where it exits the outside wall or roof in order to prevent transmission of vibration to the structure.
Wall Thickness Guidelines
24" maximum
3/4" minimum
inside
Wall
outside
insulation
(if required)

Figure 14

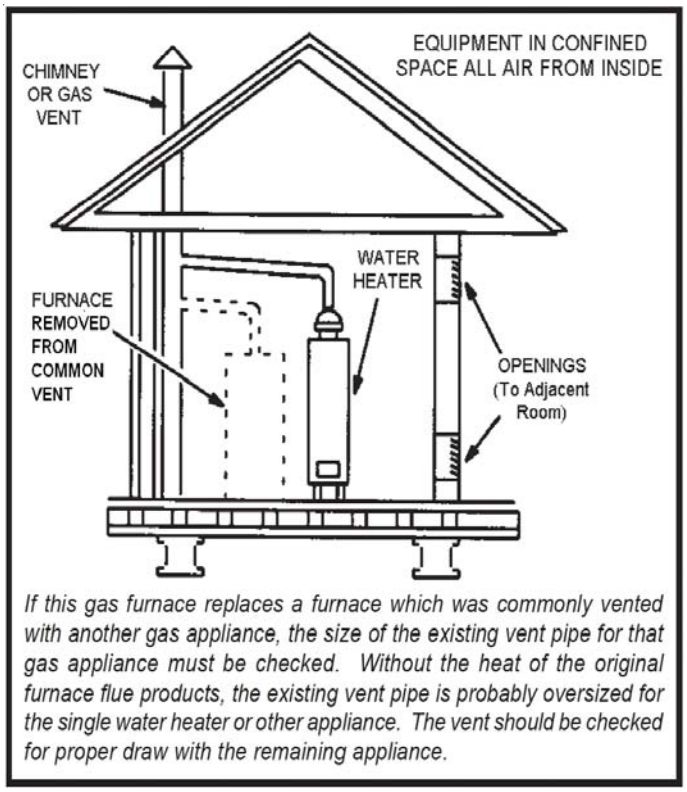

EQUIPMENT IN CONFINED SPACE ALL AIR FROM INSIDE
CHIMNEY OR GAS VENT
WATER HEATER
FURNACE REMOVED FROM COMMON VENT
OPENINGS (To Adjacent Room)
If this gas furnace replaces a furnace which was commonly vented with another gas appliance, the size of the existing vent pipe for that gas appliance must be checked. Without the heat of the original furnace flue products, the existing vent pipe is probably oversized for the single water heater or other appliance. The vent should be checked for proper draw with the remaining appliance.

FIGURE 15

1. In areas where piping penetrates joist or interior walls, hole must be large enough to allow clearance on all sides of pipe through center of hole using a hanger.
2. When furnace is installed in a residence where unit is shut down for an extended period of time, such as a vacation home, make provisions for draining condensate collection from trap and lines.

⚠ CAUTION

Do not discharge exhaust into an existing stack or stack that also serves another gas appliance. If vertical discharge through an existing unused stack is required, insert PVC pipe inside the stack until the end is even with the top or outlet end of the metal stack.

⚠ CAUTION

The exhaust vent pipe operates under positive pressure and must be completely sealed to prevent leakage of combustion products into the living space.

Removal of the Furnace from Common Vent

In the event that an existing furnace is removed from a venting system commonly run with separate gas appliances, the venting system is likely to be too large to properly vent the remaining attached appliances.

Conduct the following test while each appliance is operating and the other appliances (which are not operating) remain connected to the common venting system. If the venting system has been installed improperly, you **must** correct the system as indicated in the general venting requirements section.

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow the steps outlined below for each appliance connected to the venting system being placed into operation could result in carbon monoxide poisoning or death.

The following steps shall be followed for each appliance connected to the venting system being placed into operation, while all other appliances connected to the venting system are not in operation:

1. Seal any unused openings in the common venting system.

2. Inspect the venting system for proper size and horizontal pitch. Determine that there is no blockage, restriction, leakage, corrosion, or other deficiencies which could cause an unsafe condition.
3. Close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn ON clothes dryers and any appliances not connected to the common venting system. Turn ON any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Follow the lighting instructions. Turn ON the appliance that is being inspected. Adjust the thermostat so that the appliance operates continuously.
5. After the main burner has operated for 5 minutes, test for leaks of flue gases at the draft hood relief opening. Use the flame of a match or candle.
6. After determining that each appliance connected to the common venting system is venting properly, (step 3) return all doors, windows, exhaust fans, fireplace dampers, and any other gas burning appliances to their previous mode of operation.
7. If a venting problem is found during any of the preceding tests, the common venting system must be modified to correct the problems.

   Resize the common venting system to the minimum vent pipe size determined by using the appropriate tables in the current standards of the National Fuel Gas Code ANSI Z223.1.

Vent Piping Guidelines
This unit is installed only as a Direct Vent gas central furnace.

NOTE: *In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged outdoors.*

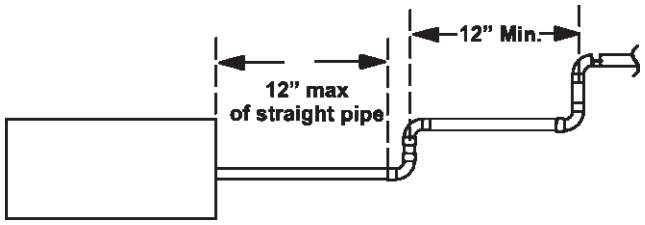
Intake and exhaust pipe sizing – Size pipe according to Tables 4 and 5. Table 4 lists the *minimum* vent pipe lengths permitted. Table 5 lists the *maximum* pipe lengths permitted.

Regardless of the diameter of pipe used, the standard roof and wall terminations described in section Exhaust Piping Terminations should be used. Exhaust vent termination pipe is sized to optimize the velocity of the exhaust gas as it exits the termination. Refer to Table 6.

In some applications which permit the use of several different sizes of vent pipe, a combination vent pipe may be used. Contact Allied Air Technical Service for more information concerning sizing of vent systems which include multiple pipe sizes.

Use the steps in Figure 17 to correctly size vent pipe diameter.

EXHAUST PIPE



Horizontal Application

NOTE: *All horizontal runs of exhaust pipe must slope back toward unit. A minimum of 1/4" (6 mm) drop for each 12" (305 mm) of horizontal run is mandatory for drainage.*

NOTE: *Exhaust pipe MUST be glued to furnace exhaust fittings.*

NOTE: *Exhaust piping should be checked carefully to make sure there are no sages or low spots.*

Figure 16

NOTE: *The exhaust collar on all models is sized to accommodate 2" Schedule 40 vent pipe. In horizontal applications, transition to exhaust pipe larger than 2" must be made in vertical runs of the pipe. A 2" elbow must be added before the pipe is transitioned to any size larger than 2". This elbow must be added to the elbow count used to determine acceptable vent lengths. Contact Allied Air Technical Service for more information concerning sizing of vent systems which include multiple pipe sizes.*

⚠ IMPORTANT

Do not use screens or perforated metal in exhaust or intake terminations. Doing so will cause freeze-ups and may block the terminations.

MINIMUM VENT PIPE LENGTHS

MODEL	MIN. EQUIV. VENT LENGTH	EXAMPLE
070, 090	15 ft.*	5ft. plus 2 elbows of 2", 2-1/2", or 3" diameter pipe
110		5 ft. plus 2 elbows of 2-1/2", 3"
135		5ft. plus 2 elbows of 3"

** Any approved termination may be added to the minimum equivalent length listed.*

Table 4

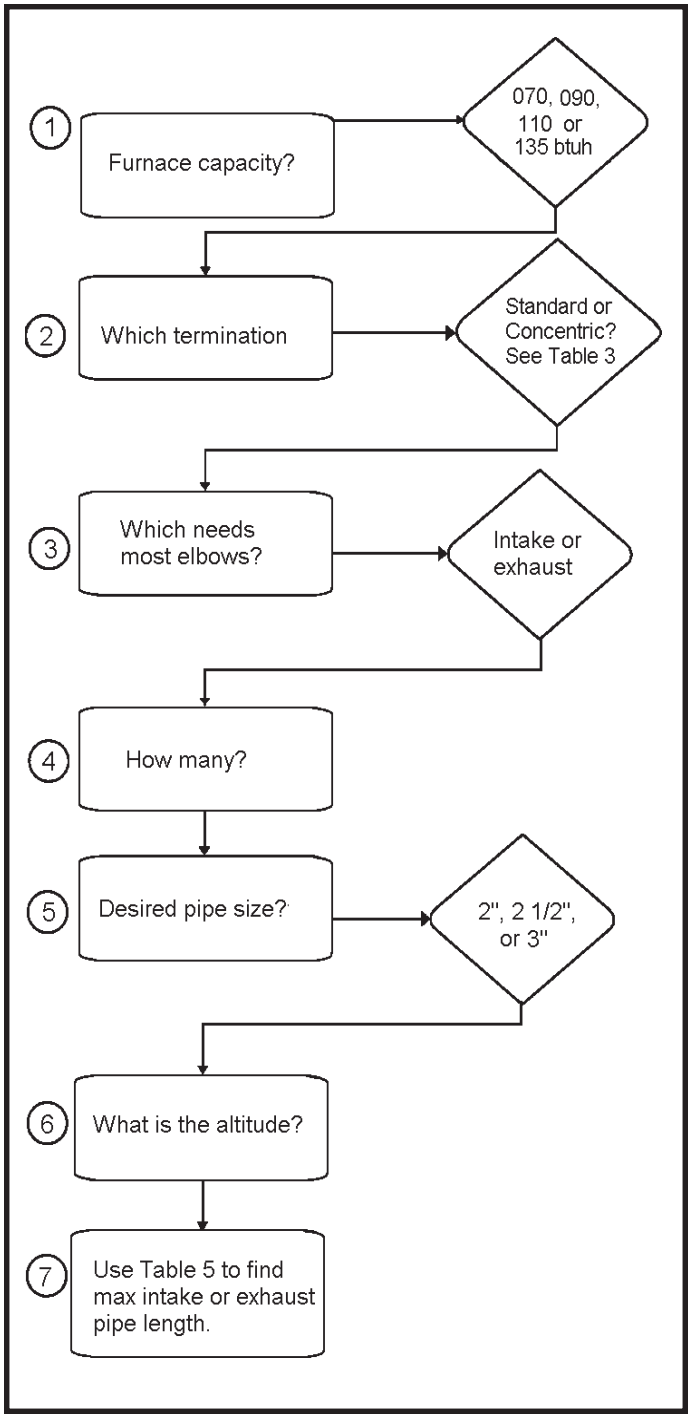

1
Furnace capacity?
070, 090, 110 or 135 btuh
2
Which termination
Standard or Concentric? See Table 3
3
Which needs most elbows?
Intake or exhaust
4
How many?
5
Desired pipe size?
2", 2 1/2", or 3"
6
What is the altitude?
7
Use Table 5 to find max intake or exhaust pipe length.

Figure 17

Maximum Allowable Intake or Exhaust Vent Length (feet)

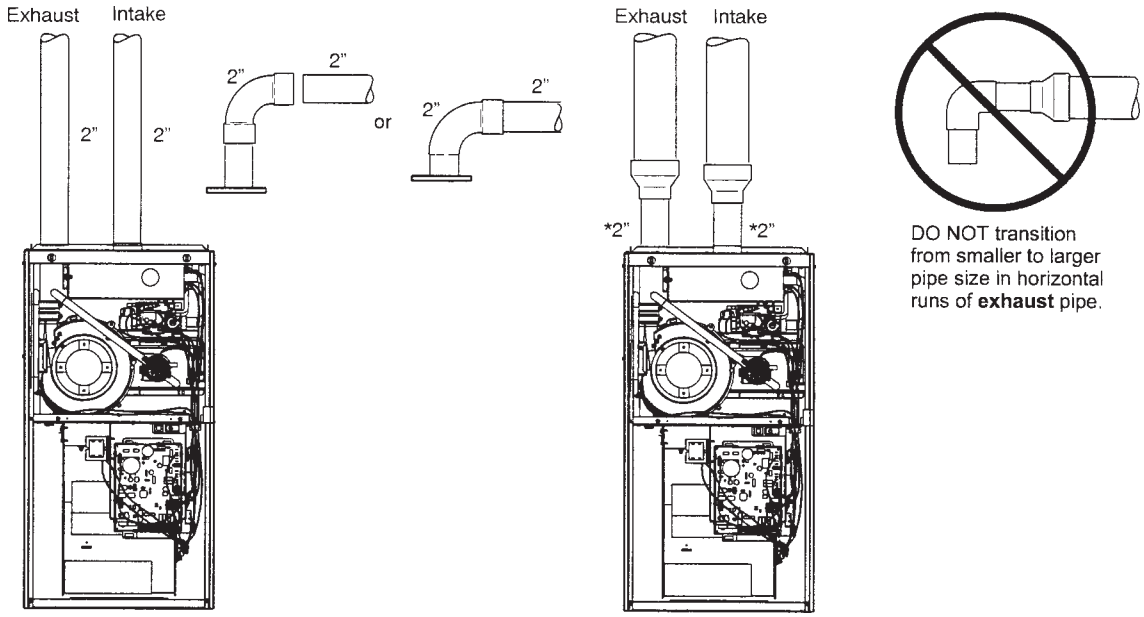
*Size intake and exhaust pipe length separately. Values in table are for Intake OR Exhaust not combined total. Both Intake and Exhaust must be same pipe size.

Standard Termination at Elevation 0 - 7500 ft												
Number Of 90° Elbows Used	2" Pipe Model				2-1/2" Pipe Model				3" Pipe Model			
	070	090	110	135	070	090	110	135	070	090	110	135
1	86	64			135	88	38		157	138	113	109
2	81	59			130	83	33		152	133	108	104
3	76	54			125	78	28		147	128	103	99
4	71	49		n/a	120	73	23		142	123	98	94
5	66	44			115	68	18	n/a	137	118	93	89
6	61	39			110	63	13		132	113	88	84
7	56	34	n/a		105	58	8		127	108	83	79
8	51	29			100	53			122	103	78	74
9	46	24			95	48	n/a		117	98	73	69
10	41	19			90	43			112	93	68	64
Standard Termination Elevation 4501 - 10,000 ft												
Number Of 90° Elbows Used	2" Pipe Model				2-1/2" Pipe Model				3" Pipe Model			
	070	090	110	135	070	090	110	135	070	090	110	135
1	61	39			110	63			132	113	88	84
2	56	34			105	58			127	108	83	79
3	51	29			100	53			122	103	78	74
4	46	24			95	48		n/a	117	98	73	69
5	41	19	n/a	n/a	90	43			112	93	68	64
6	36	14			85	38			107	88	63	59
7	31	9			80	33	nla		102	83	58	54
8	26	n/a			75	28			97	78	53	49
9	21				70	23			92	73	48	44
10	16				65	18			87	68	43	39

Concentric Termination at Elevation 0 –7,500 ft												
Number Of 90° Elbows Used	2" Pipe Model				2-1/2" Pipe Model				3" Pipe Model			
	070	090	110	135	070	090	110	135	070	090	110	135
1	78	62			125	84	34		141	134	109	100
2	73	57			120	79	29		136	129	104	95
3	68	52			115	74	24		131	124	99	90
4	63	47		n/a	110	69	19		126	119	94	85
5	58	42			105	64	14		131	114	89	80
6	53	37			100	59	9	n/a	116	109	84	75
7	48	32	n/a		95	54			111	104	79	70
8	43	27			90	49			106	99	74	65
9	38	22			85	44	n/a		101	94	69	60
10	33	17			80	39			96	89	64	55
Concentric Termination Elevation 4,501 - 10,000 ft												
Number Of 90° Elbows Used	2" Pipe Model				2-1/2" Pipe Model				3" Pipe Model			
	070	090	110	135	070	090	110	135	070	090	110	135
1	53	37			100	59			116	109	84	75
2	48	32			95	54			111	104	79	70
3	43	27			90	49			106	99	74	65
4	38	22			85	44		n/a	101	94	69	60
5	33	17	n/a	n/a	80	39			96	89	64	55
6	28	12			75	34			91	84	59	50
7	23	7			70	29	nla		86	79	54	45
8	18	n/a			65	24			81	74	49	40
9	13				60	19			76	69	44	35
10	8				55	14			71	64	39	30

Table 5

TYPICAL EXHAUST AND INTAKE PIPE CONNECTIONS IN UPFLOW APPLICATIONS

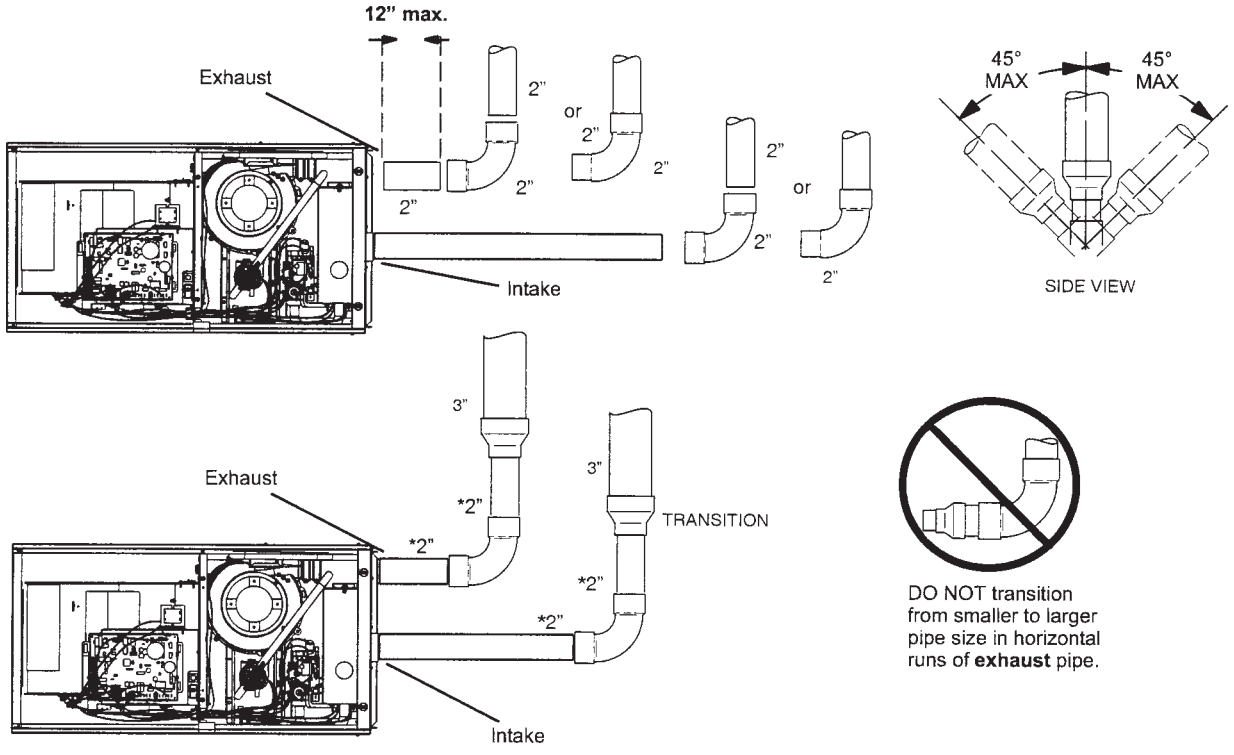


* When transitioning up in pipe size, use the shortest length of 2" PVC pipe possible.

Figure 18

TYPICAL EXHAUST AND INTAKE PIPE CONNECTIONS IN HORIZONTAL APPLICATIONS

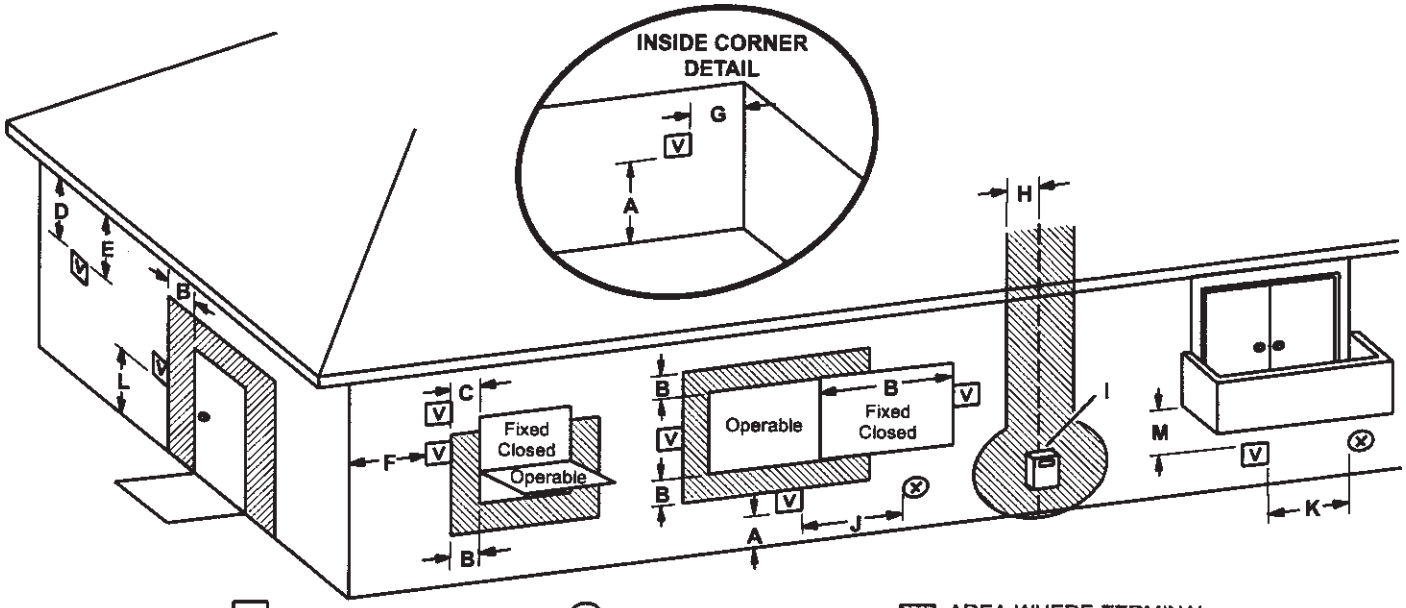
(RIGHT HAND DISCHARGE SHOWN)



* When transitioning up in pipe size, use the shortest length of 2" PVC pipe possible.

Figure 19

VENT TERMINATION CLEARANCES
FOR DIRECT VENT INSTALLATIONS IN THE USA AND CANADA



		US Installations[1]	Canadian Installations[2]
A =	Clearance above grade, veranda, porch, deck or balcony	12 inches (305mm) or 12 in. 305mm) above average snow accumulation.	12 inches (305mm) or 12 in. 305mm) above average snow accumulation.
B =	Clearance to window or door that may be opened	6 inches (152mm) for appliances <10,000 Btuh (3kw), 9 inches (mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15 kw), 12 inches (305mm) for appliances > 50,000 Btuh (15kw)	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
C =	Clearance to permanently closed window	* 12"	* 12"
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (mm) from the center line of the terminal	* Equal to or greater than soffit depth	* Equal to or greater than soffit depth
E =	Clearance to unventilated soffit	* Equal to or greater than soffit depth	* Equal to or greater than soffit depth
F =	Clearance to outside corner	* No minimum to outside corner	* No minimum to outside corner
G =	Clearance to inside corner	* 3 feet (.9m)	* 3 feet (.9m)
H =	Clearance to each side of center line extended above meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly
I =	Clearance to service regulator vent outlet	* 3 feet (.9m)	3 feet (.9m)
J =	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (152mm) for appliances <10,000 Btuh (3kw), 9 inches (mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15 kw), 12 inches (305mm) for appliances > 50,000 Btuh (15kw)	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
K =	Clearance to mechanical air supply inlet	3 feet (.9m) above if within 10 feet (3m) horizontally	6 feet (1.8m)
L =	Clearance above paved sidewalk or paved driveway located on public property	* 7 feet (2.1m)	7 feet (2.1m)†
M =	Clearance under veranda, porch, deck or balcony	*12 inches (305mm)‡	12 inches (305mm)‡

[1] In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code

[2] In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ Permitted only if veranda, porch, deck or balcony is fully open on a minimum of two sides beneath the floor. Allied Air recommends avoiding this location if possible.

For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, clearance will be in accordance with local installation codes and the requirements of the gas supplier and these installation instructions.

Figure 20

General Guidelines for Vent Terminations

In Direct Vent applications, combustion air is taken from outdoors and the flue gases are discharged to the outdoors. This gas furnace is classified as a direct vent, Category IV gas furnace.

In Direct Vent applications, the vent termination is limited by local building codes. In the absence of local codes, refer to the current National Fuel Gas Code ANSI Z223-1/NFPA 54 in U.S.A., and current CSA-B149 Natural Gas and Propane Installation Codes in Canada for details.

Position termination according to location given in Figure 20. In addition, position termination so it is free from any obstructions and 12" above the average snow accumulation.

At vent termination, care must be taken to maintain protective coatings over building materials (prolonged exposure to exhaust condensate can destroy protective coatings). It is recommended that the exhaust outlet not be located within 6 feet (1.8m) of a condensing unit because the condensate can damage the painted coating.

NOTE: *See Table* 6 *for maximum allowed exhaust pipe length without insulation in unconditioned space during winter design temperatures below 32°F* 0°C). *If equired exhaust pipe should be insulated with* 1/2" *(13mm) Armaflex or equivalent. In extreme cold climate areas, 3/4" (19mm) Armaflex or equivalent may be necessary. Insulation on outside runs of exhaust pipe must be painted or wrapped to protect insulation from deterioration. Exhaust pipe insulation may not be necessary in some specific applications.*

IMPORTANT

Do not use screens or perforated metal in exhaust terminations. Doing so will cause freeze-ups and may block the terminations.

IMPORTANT

FOR CANADIAN INSTALLATIONS ONLY:

In accorddance to CSA International B149 installation codes, the minimum allowed distance between the combustion air intake inlet and the exhaust outlet of other appliances shall not be less than 12 inches (305 mm).

Maximum Allowable Vent pipe Length without Insulation in Unconditioned Space for Winter Design Temperatures Modulating High Efficiency Furnace

Winter Design Temperatures[1] °F (°C)	Vent Pipe Diameter	Unit Input Size			
		070	090	110	135
32 to 21 ((0 to -6)	2 in.	8	14	14	n/a
	2-1/2 in.	6	9	12	n/a
	3 in.	4	6	8	12
20 to 1 (-7 to -17)	2 in	5	7	8	n/a
	2-1/2 in.	4	5	6	n/a
	3 in.	2	2	4	6
0 to -20 (-18 to -29)	2 in.	3	4	5	n/a
	2-1/2 in.	2	2	3	n/a
	3 in.	1	1	1	2

[1]Refer to 99% Minimum Design Temperature table provided in the current edition of the ASHRAE Fundamentals Handbook.
NOTE: Maximum unisulated vent lengths listed cannot exceedd the maximum allowable intake or exhaust vent length listed in Table 5.

Table 6

Details of Intake and Exhaust Piping Terminations for Direct Vent Installations

NOTE: *In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged to outdoors.*

Intake and exhaust pipes may be routed either horizontally through and outside wall or vertically through the roof. In attic or closet installations, vertical termination through the roof is preferred. Figures 23 through 29 show typical terminations.

1. Intake and exhaust terminations are not required to be in the same pressure zone. You may exit the intake on one side of the structure and the exhaust on another side (Figure 20). You may exit the exhaust out the roof and the intake out the side of the structure (Figure 21).
2. Intake and exhaust pipes should be placed as close together as possible at termination end (refer to illustrations). Maximum separation is 3" (76 mm) on roof terminations and 6" (152 mm) on sidewall terminations.
3. On roof terminations, the intake piping should terminate straight down using two 90° elbows (See Figure 21).
4. Exhaust piping must terminate straight out or up as shown. A reducer is required on the exhaust piping at the point where it exits the structure to improve the velocity of exhaust away from the intake piping. See Table 6.

NOTE: *Care must be taken to avoid recirculation of exhaust back into intake pipe.*

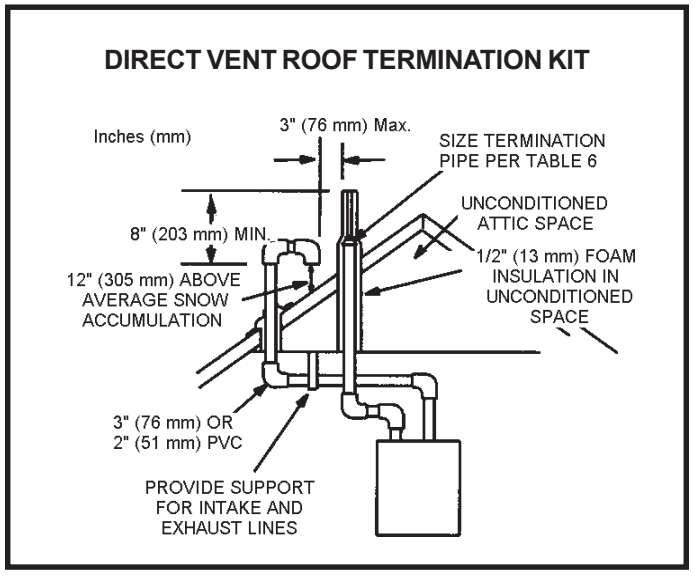

DIRECT VENT ROOF TERMINATION KIT
Inches (mm)
3" (76 mm) Max.
SIZE TERMINATION PIPE PER TABLE 6
UNCONDITIONED ATTIC SPACE
8" (203 mm) MIN.
1/2" (13 mm) FOAM INSULATION IN UNCONDITIONED SPACE
12" (305 mm) ABOVE AVERAGE SNOW ACCUMULATION
3" (76 mm) OR 2" (51 mm) PVC
PROVIDE SUPPORT FOR INTAKE AND EXHAUST LINES

Figure 21

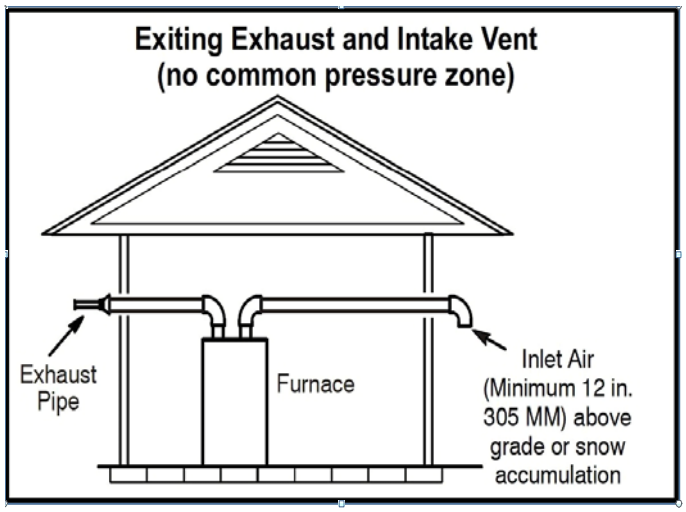

Exiting Exhaust and Intake Vent
(no common pressure zone)
Exhaust Pipe
Furnace
Inlet Air (Minimum 12 in. 305 MM) above grade or snow accumulation

Figure 22

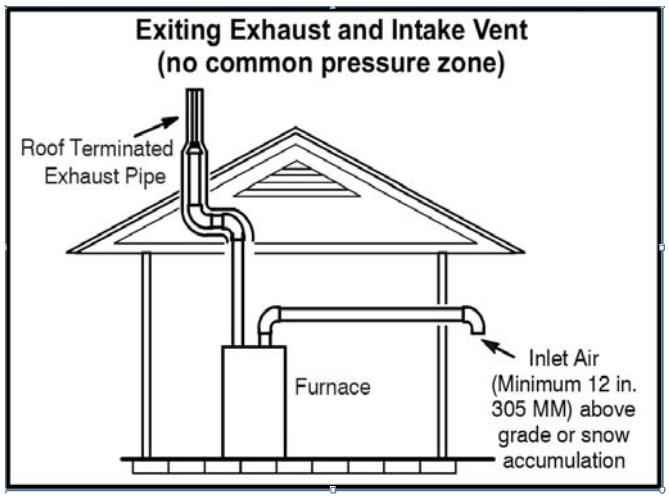
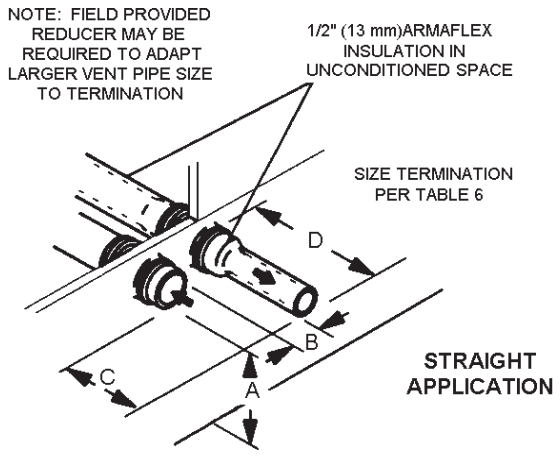
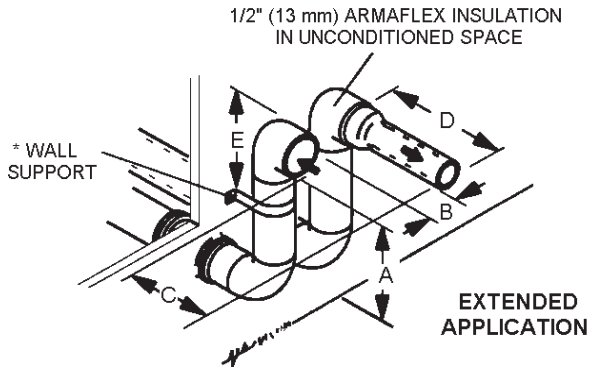

Exiting Exhaust and Intake Vent
(no common pressure zone)
Roof Terminated Exhaust Pipe
Furnace
Inlet Air (Minimum 12 in. 305 MM) above grade or snow accumulation

Figure 23

FIELD SUPPLIED WALL TERMINATION OR


NOTE: FIELD PROVIDED REDUCER MAY BE REQUIRED TO ADAPT LARGER VENT PIPE SIZE TO TERMINATION
1/2" (13 mm)ARMAFLEX INSULATION IN UNCONDITIONED SPACE
SIZE TERMINATION PER TABLE 6
D
B
C
A
STRAIGHT APPLICATION



See venting Table 5 for maximum venting lengths with this arrangement.

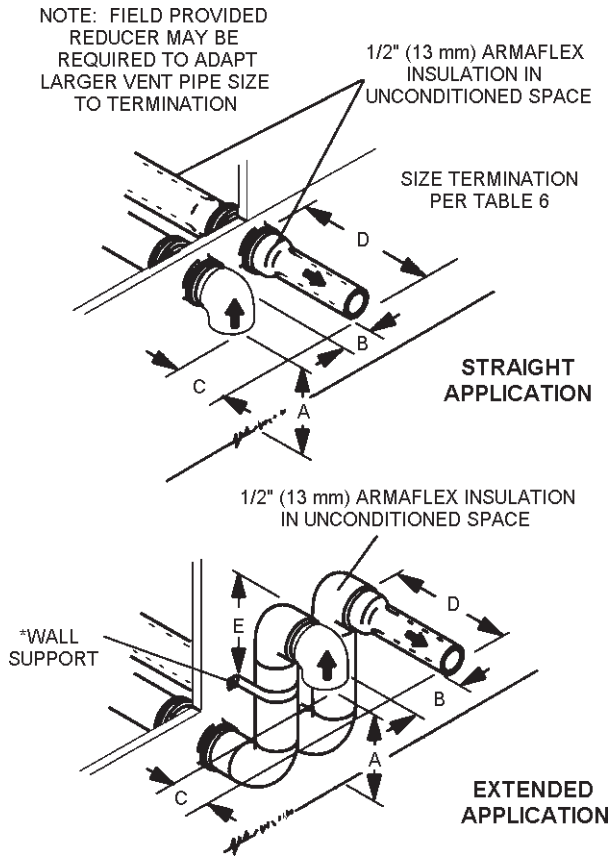
* Use wall support every 24” (610 mm). Use two wall supports if extension is greater than 24” (610 mm) but less than 48” (1219 mm).

NOTE: *One wall support must be 6” (152 mm) from top of each pipe*

	2" (51 mm) Vent Pipe	3" (76 mm) Vent Pipe
A-Minimum clearance above grade or average snow accumulation	12" (305 mm)	12" (305 mm)
B-Maximum horizontal separation between intake and exhaust	6" (152 mm)	6" (152 mm)
C-Minimum from end of exhaust to inlet of intake	8" (203 mm)	8" (203 mm)
D-Maximum exhaust pipe length	12" (305 mm)	20" (508 mm)
E-Maximum wall support distance from top of each pipe (intake/exhaust)	6" (152 mm)	6" (152 mm)

Figure 24

FIELD SUPPLIED WALL TERMINATION with INTAKE ELBOW



See venting Table 5 for maximum venting lengths with this arrangement.

* Use wall support every 24" (610 mm). Use two wall supports if extension is greater than 24" (610 mm) but less than 48" (1219 mm).

NOTE: *One wall support must be 6" (152 mm) from top of each pipe (intake and exhaust).*

	2" (51 mm) Vent Pipe	3" (76 mm) Vent Pipe
A-Minimum clearance above grade or average snow accumulation	12" (305 mm)	12" (305 mm)
B-Maximum horizontal separation between intake and exhaust	6" (152 mm)	6" (152 mm)
C-Minimum from end of exhaust to inlet of intake	6" (152 mm)	6" (152 mm)
D-Maximum exhaust pipe length	12" (305 mm)	20" (508 mm)
E-Maximum wall support distance from top of each pipe (intake/exhaust)	6" (152 mm)	6" (152 mm)

Figure 25

EXHAUST PIPE TERMINATION SIZE REDUCTION

MODEL	Exhaust Pipe Size	Termination Pipe Size
070 *	2", 2-1/2" or 3"	1-1/2"
090 *	2", 2-1/2" or 3"	2"
110	2-1/2" or 3"	2"
135	3"	2"

** 070 and 090 units installed with flush mount termination must use the 1-1/2" accelerator supplied with the kit.*

Table 7

5. On field supplied terminations for sidewall exit, exhaust piping may extend a maximum of 12 inches (305 mm) for 2" PVC and 20 inches (508 mm) for 3" (76 mm) PVC beyond the outside wall. Intake piping should be as short as possible. See Figures 22 and 23.
6. On field supplied terminations, a minimum distance between the end of the exhaust pipe and the end of the intake pipe without a termination elbow is 8" and a minimum distance of 6" with a termination elbow. See Figures 22 and 23.
7. If intake and exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported every 24" (610 mm) as shown in Figures 22 and 23. In addition, close coupled wall termination must be extended for use in this application. See Figures 22 and 23. When exhaust and intake piping must be run up an with pipe sized per Table 7. The intake piping may be equipped with a 90° elbow turndown. Using turndown will add 5 feet (1.5 m) to the equivalent length of the pipe.

DIRECT VENT CONCENTRIC ROOFTOP TERMINATION 71M80, 69M29 or 60L46 (US) 44W92 or 44W93 (Canada)

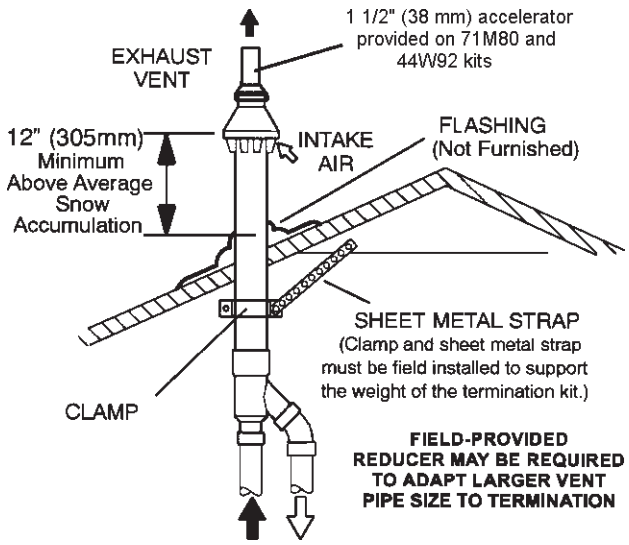

1 1/2" (38 mm) accelerator provided on 71M80 and 44W92 kits
EXHAUST VENT
12" (305mm) Minimum Above Average Snow Accumulation
INTAKE AIR
FLASHING (Not Furnished)
SHEET METAL STRAP
(Clamp and sheet metal strap must be field installed to support the weight of the termination kit.)
CLAMP
FIELD-PROVIDED REDUCER MAY BE REQUIRED TO ADAPT LARGER VENT PIPE SIZE TO TERMINATION

Figure 26

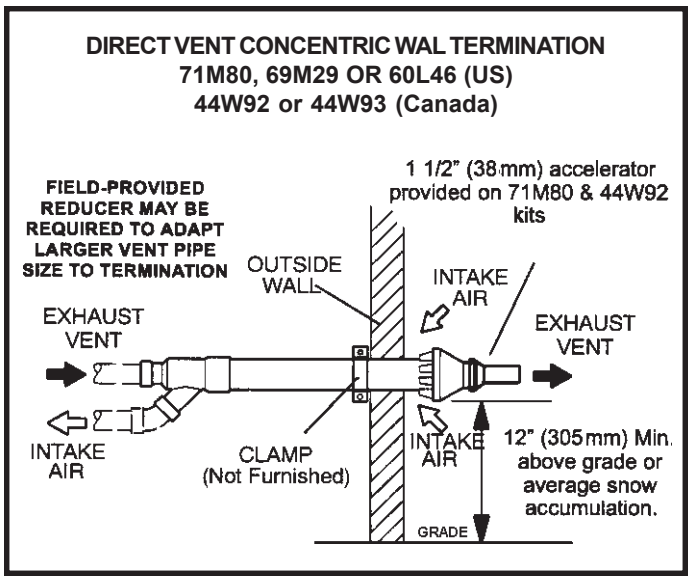

DIRECT VENT CONCENTRIC WAL TERMINATION
71M80, 69M29 OR 60L46 (US)
44W92 or 44W93 (Canada)
FIELD-PROVIDED REDUCER MAY BE REQUIRED TO ADAPT LARGER VENT PIPE SIZE TO TERMINATION
1 1/2" (38 mm) accelerator provided on 71M80 & 44W92 kits
OUTSIDE WALL
INTAKE AIR
EXHAUST VENT
EXHAUST VENT
INTAKE AIR
CLAMP (Not Furnished)
INTAKE AIR
12" (305 mm) Min. above grade or average snow accumulation.
GRADE

Figure 27

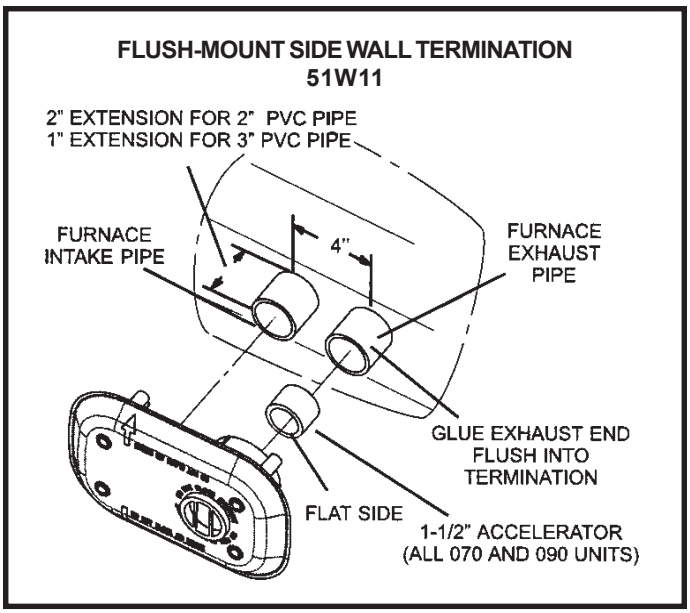
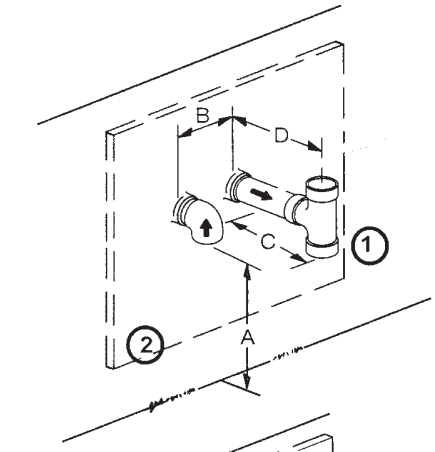
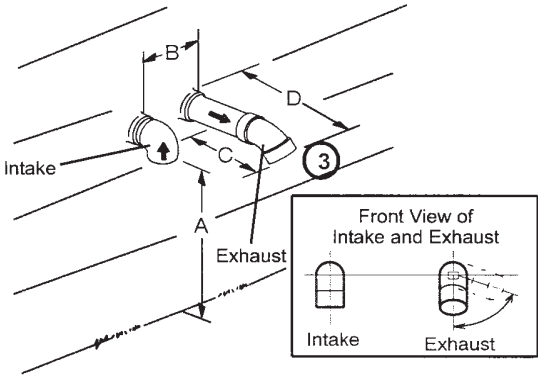


Figure 28





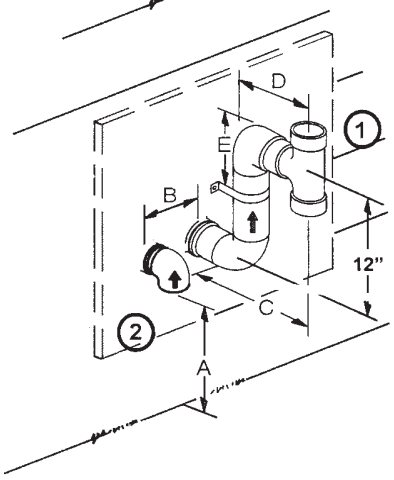


TABLE 8

	2" (51mm) Vent Pipe	3" (76mm) Vent Pipe
A- Clearance above grade or average snow accumulation	12" (305MM) Min.	12" (305MM) Min.
B-Horizontal separation between intake and exhaust	6" (152MM) Min. 24" (610 MM) Max	6" (152MM) Min. 24" (610 MM) Max
C-Minimum from end of exhaust to inlet of intake	9" (227MM) Min.	9" (227MM) Min.
D-Exhaust pipe length	12" (305MM) Min. 16" (405 MM) Max.	12" (305MM) Min. 20" (508MM) Max.
E-Wall support distance from top of each pipe (intake/exhaust)	6" (152MM) Max.	6" (152MM) Max.

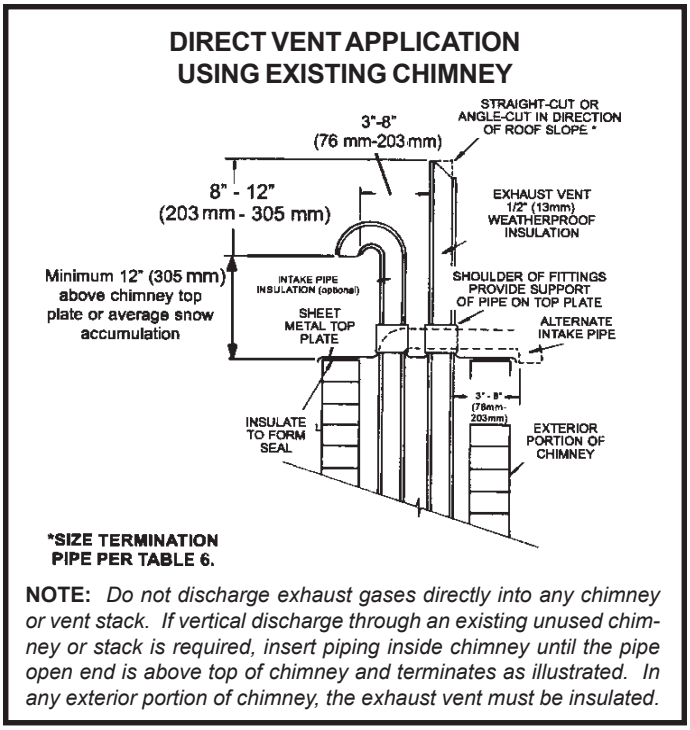
NOTE - See unit installation instructions for proper exhaust pipe termination size reduction.

[1] The exhaust termination tee should be connected to the 2" or 3" PVC flue pipe as shown in the illustration. Do not use an accelerator in applications that include an exhaust termination tee. The accelerator is not required.

[2] As required. Flue gas may be acidic and may adversely affect some building materials. If a side wall vent termination is used and flue gases will impinge on the building materials, a corrosion-resistant shield (24 inches square) should be used to protect the wall surface. If optional tee is used, the protective shield is recommended. The shield should be constructed using wood, sheet metal or other suitable material. All seams, joints, cracks, etc. in affected area, should be sealed using an appropriate sealant.

[3] Exhaust pipe 45° elbow can be rotated to the side away from the combustion air inlet to direct exhaust away from adjacent property. The exhaust must never be directed toward the combustion air inlet.

Figure 29


DIRECT VENT APPLICATION
USING EXISTING CHIMNEY
STRAIGHT-CUT OR ANGLE-CUT IN DIRECTION OF ROOF SLOPE *
3"-8" (76 mm-203 mm)
8" - 12" (203 mm - 305 mm)
EXHAUST VENT 1/2" (13mm) WEATHERPROOF INSULATION
Minimum 12" (305 mm) above chimney top plate or average snow accumulation
INTAKE PIPE INSULATION (optional)
SHEET METAL TOP PLATE
SHOULDER OF FITTINGS PROVIDE SUPPORT OF PIPE ON TOP PLATE
ALTERNATE INTAKE PIPE
3" - 8" (76mm-203mm)
INSULATE TO FORM SEAL
EXTERIOR PORTION OF CHIMNEY
*SIZE TERMINATION PIPE PER TABLE 6.

NOTE: *Do not discharge exhaust gases directly into any chimney or vent stack. If vertical discharge through an existing unused chimney or stack is required, insert piping inside chimney until the pipe open end is above top of chimney and terminates as illustrated. In any exterior portion of chimney, the exhaust vent must be insulated.*

Figure 30

Condensate Piping

This unit is designed for either right or left side exit of condensate piping in upflow applications. In horizontal applications, the condensate trap must extend below the unit. An 8" service clearance is required for the condensate trap. Refer to Figure 34 for condensate trap locations.

NOTE: *If necessary the condensate trap may be installed up to 5" away using PVC pipe from the furnace. Piping from furnace must slope down a minimum of 1/4" per ft. toward trap.*

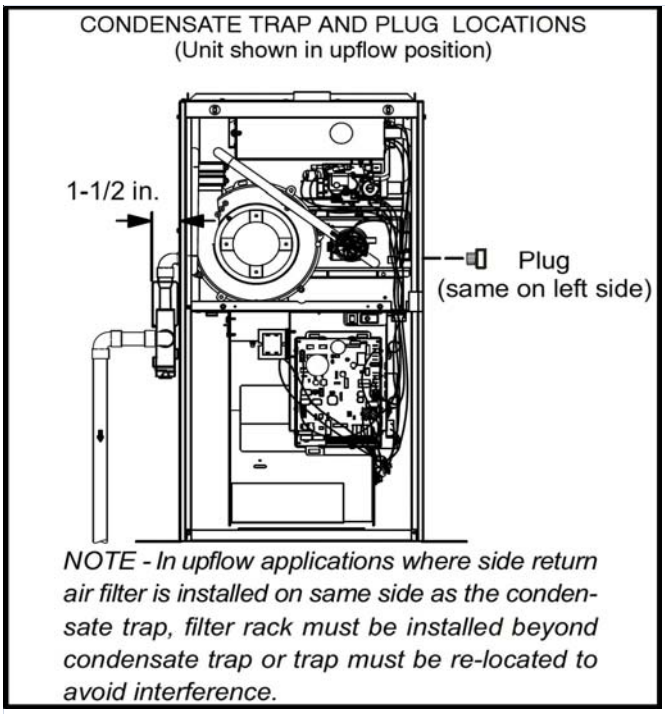

CONDENSATE TRAP AND PLUG LOCATIONS
(Unit shown in upflow position)
1-1/2 in.
Plug
(same on left side)
NOTE - In upflow applications where side return air filter is installed on same side as the condensate trap, filter rack must be installed beyond condensate trap or trap must be re-located to avoid interference.

Figure 31

1. Determine which side condensate piping will exit the unit, location of trap, field-provided fittings and length of PVC pipe required to reach available drain.
2. Use a 3/8 allen wrench and remove plug (Figure 30) from the cold end header box at the appropriate location on the side of the unit. Install field-provided 1/ 2 NPT male fitting into cold end header box. UseTeflon tape or appropriate pipe dope.
3. Install the cap over the clean out opening at the base of the trap. Secure with clamp. See Figure 33.
4. Install drain trap using appropriate PVC fittings, glue all joints. Glue the provided drain trap as shown in Figure 33. Route the condensate line to an open drain.*Conden -sate line must maintain a 1/4" downward slope from the furnace to the drain.*
5. Figures 33 and 34 show the furnace and evaporator coil using a separate drain. If necessary the condensate line from the furnace and evaporator coil can drain together. See figures 35, 36 and 37.

   Upflow furnace (figure 30) - In upflow furnace applications the field provided vent must be a minimum 1" to a maximum 2" length above the condensate drain outlet connection. Any length above 2" may result in a flooded heat ex -changer if the combined primary drain line were to bec -ome restricted.

   Horizontal furnace (figure 33 or 37) - In horizontal furnace applications the field provided vent must be a minimum 4" to a maximum 5" length above the condensate drain outlet connection. Any length above 5" may result in a flooded heat excha- nger if the combined primary drain line were to become restricted.

   NOTE - In horizontal applications it is recommended to install a secondary drain pan underneath the unit and trap assembly.

   NOTE - Vinyl tubing may be used for condensate drain.Tubing must be 1"1/4" OD X 1" ID and should be attached to the drain on the trap using a hose clamp.
6. If unit will be started immediately upon completion of installation, prime trap per procedure outlined in Unit Start-Up section.

Condensate line must slope downward away from the trap to drain. If drain level is above condensate trap, condensate pump must be used. Condensate drain line should be routed within the conditioned space to avoid freezing of condensate and blockage of drain line. If this is not possible, a heat cable kit may be used onthe condensate trap and line. Heating cable kit is available in various lengths; 6 ft. (1.8 m) - kit no.26K68; 24 ft. (7.3 m) - kit no. 26K69; and 50 ft. (15.2 m) - kit no. 26K70.

⚠ CAUTION

Do not use copper tubing or existing copper condensate lines for drain line.

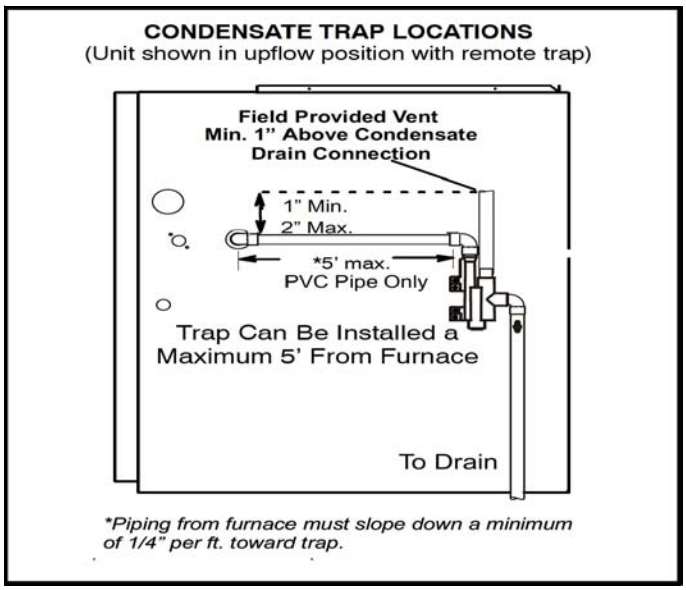

CONDENSATE TRAP LOCATIONS
(Unit shown in upflow position with remote trap)
Field Provided Vent
Min. 1" Above Condensate
Drain Connection
1" Min.
2" Max.
*5' max.
PVC Pipe Only
Trap Can Be Installed a
Maximum 5' From Furnace
To Drain
*Piping from furnace must slope down a minimum of 1/4" per ft. toward trap.

Figure 32

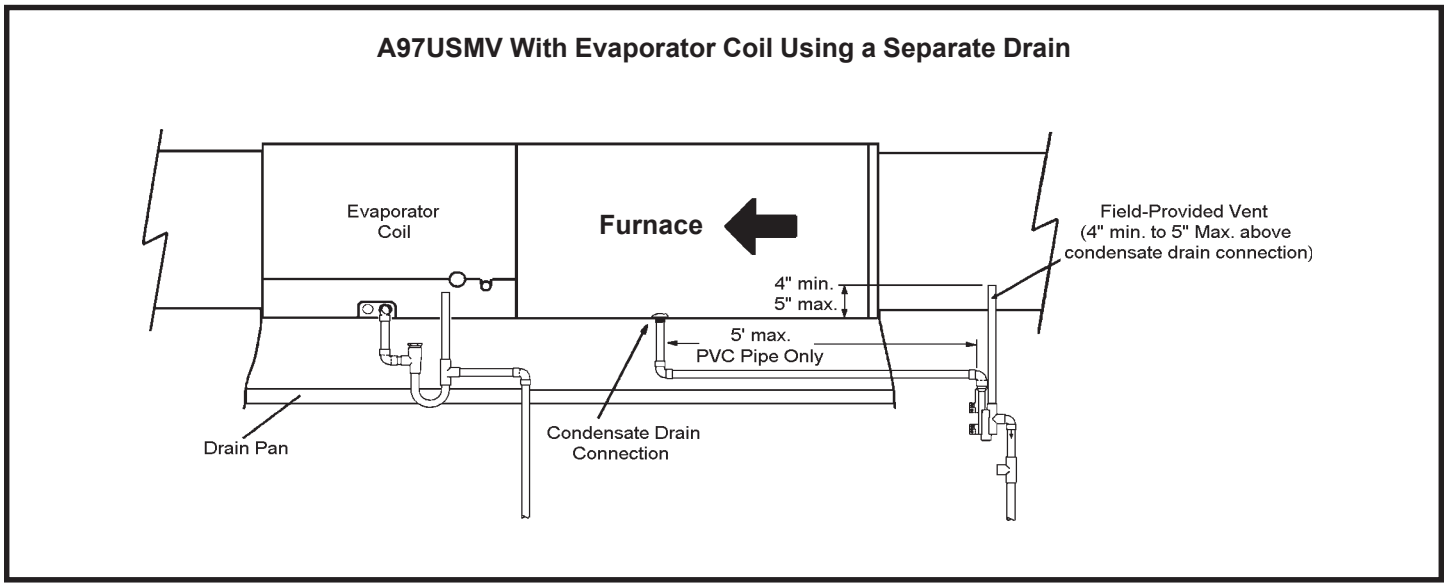


Figure 33

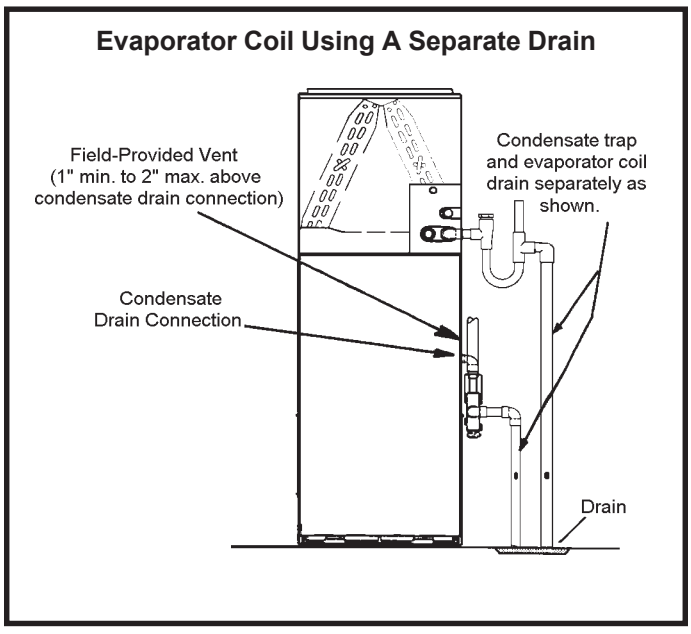


Figure 34

⚠ CAUTION

A separate drain line must be run to the drain from the condensate trap. **DO NOT** connect the condensate trap drain into the drain line from the evaporator coil.

IMPORTANT

When combining the furnace and evaporator coil drains together, the A/C condensate drain outlet must be vented to relieve pressure in order for the furnace pressure switch to operate properly.

Condensate Trap with Optional Overflow Switch

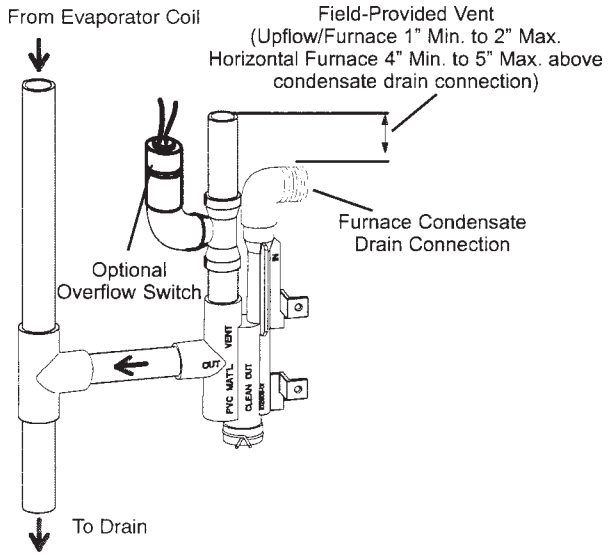


Figure 35

Evaporator Coil using a Common Drain

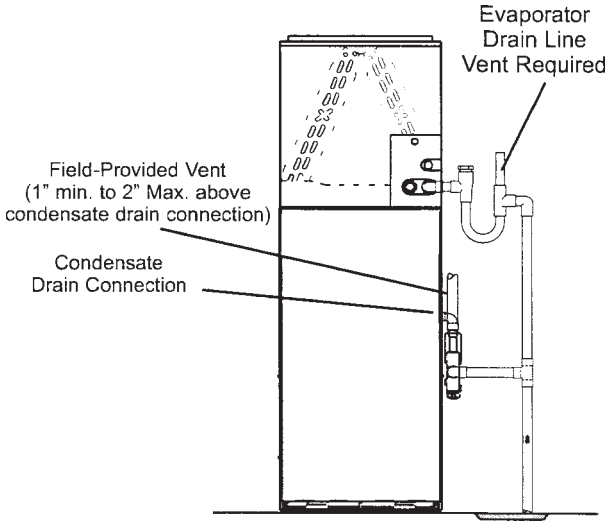
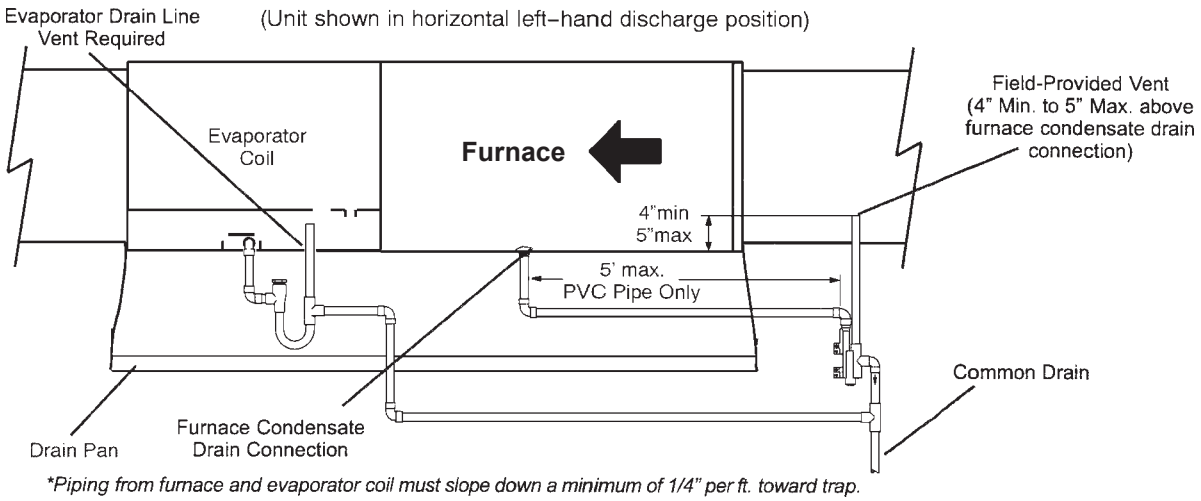


Figure 36

Evaporator Coil using a Common Drain

(Unit shown in Horizontal Left-Hand Discharge Position)



**Piping from furnace and evaporator coil must slope down a minimum of 1/4" per ft. toward trap.*

Figure 37

Trap / Drain Assembly using 1/2” PVC or 3/4” PVC

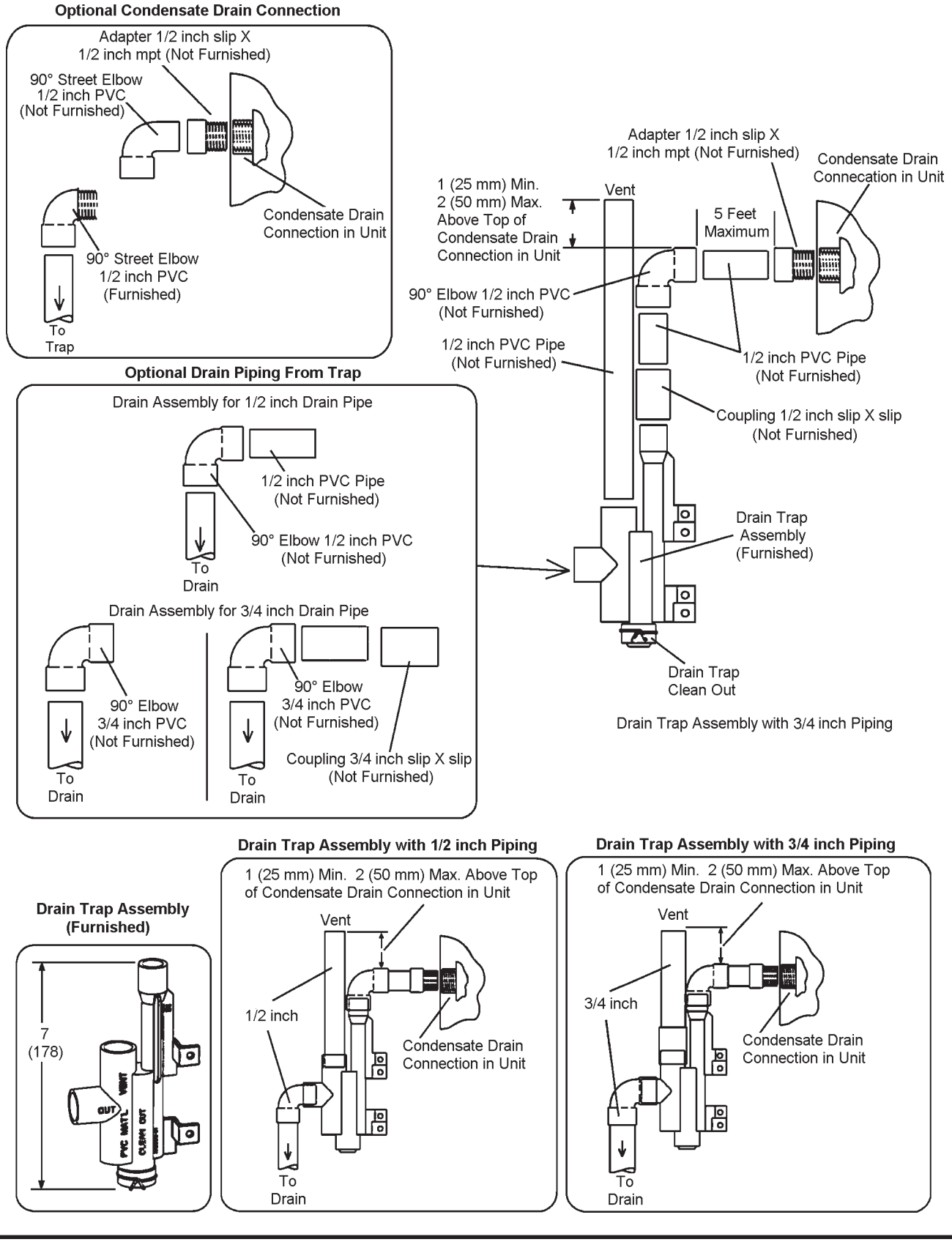


Figure 38

Gas Piping

⚠ CAUTION

If a flexible gas connector is required or allowed by the authority that has jurisdiction, black iron pipe shall be installed at the gas valve and extend outside the furnace cabinet. The flexible connector can then be added between the black iron pipe and the gas supply line.

⚠ WARNING

Do not exceed 600 in.-lbs. (50 ft.-lbs.) torque when attaching the gas piping to the gas valve.

1. Gas piping may be routed into the unit through either the left or right hand side in upflow applications, and either the top or bottom in horizontal applications. Supply piping enters into the gas valve from the side of the valve as shown in Figures 36 and 37.
2. When connecting gas supply, factors such as length of run, number of fittings and furnace rating must be considered to avoid excessive pressure drop. Table 7 list recommended pipe sizes for typical applications.

   NOTE: *Use two wrenches when connecting gas piping to avoid transferring torque to the manifold.*

3. Gas piping must not run in or through air ducts, clothes chutes, chimneys or gas vents, dumb waiters or elevator shafts. Center gas line through piping hole. Gas line should not touch side of unit. See Figures 36 and 37.
4. Piping should be sloped 1/4 " per 15 feet (6 mm per 5.6 m) upward toward the gas meter from the furnace. The piping must be supported at proper intervals, every 8 to 10 feet (2.44 to 3.05 m), using suitable hangers or straps. Install a drip leg in vertical pipe runs to serve as a trap for sediment or condensate.
5. A 1/8" N.P.T. plugged tap or pressure post is located on the gas valve to facilitate test gauge connection. See Figure 42.
6. In some localities, codes may require installation of a manual main shut off valve and union (furnished by installer) external to the unit. Union must be of the ground joint type.

⚠ IMPORTANT

Compounds used on threaded joints of gas piping must be resistant to the actions of liquified petroleum gases.

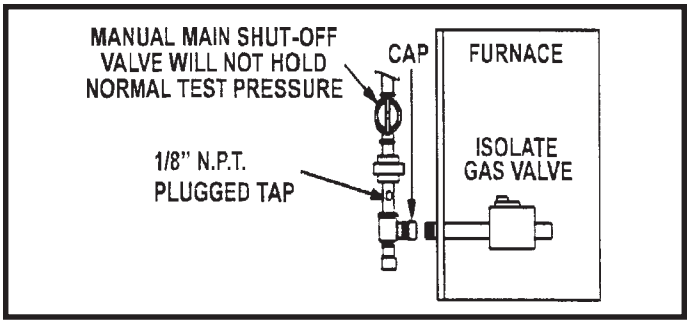


Figure 35

Leak Check

After gas piping is completed, carefully check all piping connections (factory and field installed) for gas leaks. Use a leak detecting solution or other preferred means. Do not test with open flame

The furnace must be isolated from the gas supply system by closing its individual manual shut-off valve during any pressure testing of the gas supply system at pressures more than or equal to 1/2 psig (3.48 kPa, 14 inches w.c.).

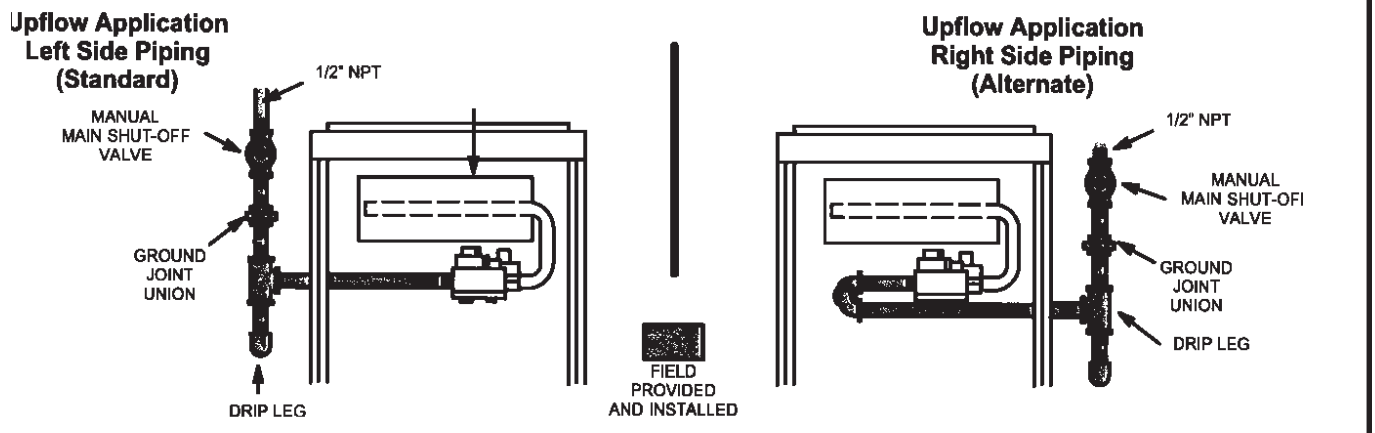
⚠ IMPORTANT

When testing gas lines using pressures in excess of 1/2 psig (3.48kPa), gas valve must be disconnected and isolated. See Figure 35. Gas valves can be damaged if subjected to pressures greater than 1/2 psig (3.48 kPa).

⚠ WARNING

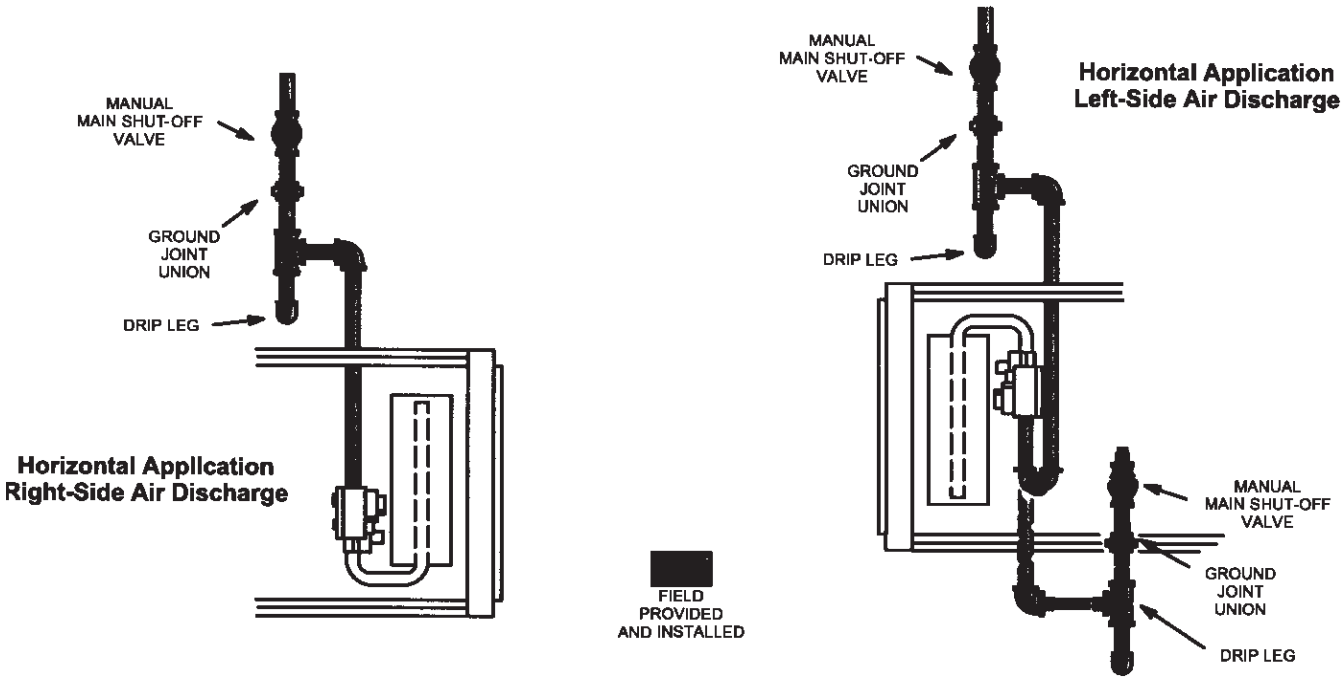
FIRE OR EXPLOSION HAZARD

Failure to follow the safety warnings exactly could result in serious injury, death, or property damage. Never use an open flame to test for gas leaks. Check all connections using a commercially available soap solution made specifically for leak detection. Some soaps used for leak detection are corrosive to certain metals. Carefully rinse piping thoroughly after leak test has been completed.



NOTE: *BLACK IRON PIPE **ONLY** TO BE ROUTED INSIDE OF CABINET*

Figure 36



NOTE: *BLACK IRON PIPE **ONLY** TO BE ROUTED INSIDE OF CABINET*

Figure 37

GAS PIPE CAPACITY - FT³/HR (kL/HR)

Nominal Iron Pipe Size -Inches(mm)	Internal Diameter -Inches(mm)	Length of Pipe-Feet(m)									
		10 (3.048)	20 (6.096)	30 (9.144)	40 (12.192)	50 (15.240)	60 (18.288)	70 (21.336)	80 (24.384)	90 (27.432)	100 (30.480)
1/2 (12.7)	.622 (17.799)	175 (4.96)	120 (3.40)	97 (2.75)	82 (2.32)	73 (2.07)	66 (1.87)	61 (1.73)	57 (1.61)	53 (1.50)	50 (1.42)
3/4 (19.05)	.824 (20.930)	360 (10.19)	250 (7.08)	200 (5.66)	170 (4.81)	151 (4.28)	138 (3.91)	125 (3.54)	118 (3.34)	110 (3.11)	103 (2.92)
1 (25.4)	1.049 (26.645)	680 (19.25)	465 (13.17)	375 (10.62)	320 (9.06)	285 (8.07)	260 (7.36)	240 (6.80)	220 (6.23)	205 (5.80)	195 (5.52)
1-1/4 (31.75)	1.380 (35.052)	1400 (39.64)	950 (26.90)	770 (21.80)	660 (18.69)	580 (16.42)	530 (15.01)	490 (13.87)	460 (13.03)	430 (12.18)	400 (11.33)
1-1/2 (38.1)	1.610 (40.894)	2100 (59.46)	1460 (41.34)	1180 (33.41)	990 (28.03)	900 (25.48)	810 (22.94)	750 (21.24)	690 (19.54)	650 (18.41)	620 (17.56)
2 (50.8)	2.067 (52.502)	3950 (111.85)	2750 (77.87)	2200 (62.30)	1900 (53.80)	1680 (47.57)	1520 (43.04)	1400 (39.64)	1300 (36.81)	1220 (34.55)	1150 (32.56)
2-1/2 (63.5)	2.469 (67.713)	6300 (178.39)	4350 (123.17)	3520 (99.67)	3000 (84.95)	2650 (75.04)	2400 (67.96)	2250 (63.71)	2050 (58.05)	1950 (55.22)	1850 (52.38)
3 (76.2)	3.068 (77.927)	11000 (311.48)	7700 (218.03)	6250 (176.98)	5300 (150.07)	4750 (134.50)	4300 (121.76)	3900 (110.43)	3700 (104.77)	3450 (97.69)	3250 (92.03)
4 (101.6)	4.026 (102.260)	23000 (651.27)	15800 (447.39)	12800 (362.44)	10900 (308.64)	9700 (274.67)	8800 (249.18)	8100 (229.36)	7500 (212.37)	7200 (203.88)	6700 (189.72)

NOTE: *Capacity given in cubic feet of gas per hour (kilo liters of gas per hour) and based on 0.60 specific gravity gas.*

Table 7

Electrical

ELECTROSTATIC DISCHARGE (ESD)
Precautions and Procedures

⚠ CAUTION

Electrostatic discharge can affect electronic components. Take precautions during furnace installation and service to protect the furnace's electronic controls. Precautions will help to avoid control exposure to electrostatic discharge by putting the furnace, the control and the technician at the same electrostatic potential. Neutralize electrostatic charge by touching hand and all tools on an unpainted unit surface, such as the gas valve or blower deck, before performing any service procedure.

INTERIOR MAKE-UP BOX INSTALLATION

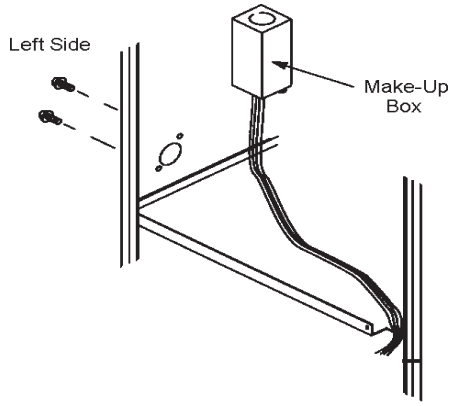


Figure 38

INTERIOR MAKE-UP BOX INSTALLATION

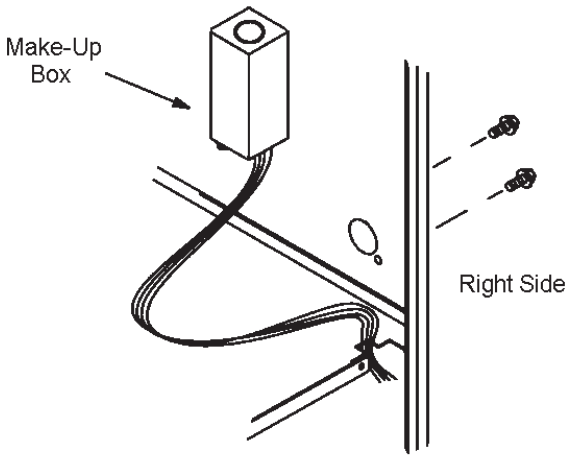


Figure 39

The unit is equipped with a field makeup box. The makeup box may be moved to the right side of the furnace to facilitate installation. If the make up box is moved to the right side, clip the wire ties that bundle the wires together. The excess wire must be pulled into the blower compartment. Secure the excess wire to the existing harness to protect it from damage. Seal unused openings on left side with plugs removed from right side.

1. The power supply wiring must meet Class I restrictions. Protected by either a fuse or circuit breaker, select circuit protection and wire size according to unit nameplate.

NOTE: *Unit nameplate states maximum current draw. See table for maximum over-current protection.*

A97USMV Model	Maximum Over Current Protection (Amps)
070B12, 090C12, 090C16	15
090C20, 110C20, 135D20	20

Table 8

2. Holes are on both sides of the furnace cabinet to facilitate wiring.
3. Install a separate (properly sized) disconnect switch near the furnace so that power can be turned off for servicing.
4. Before connecting the thermostat check to make sure the wires will be long enough for servicing at a later date. Make sure that the thermostat wire is long enough to facilitate future removal of blower for service.
5. Complete the wiring connections to the equipment. Use the provided unit wiring diagram and the field wiring diagram shown in Figure 40 and Table 11. Use 18 gauge wire or larger that is suitable for Class II rating for thermostat connections.
6. Electrically ground the unit according to local codes or, in the absence of local codes, according to the current National Electric Code (ANSI/HFPA No. 70) for the USA and current Canadian Electric Code Part 1 (CSA standard C22.1) for Canada. A green ground wire is provided in the field make up box.
7. One line voltage "EAC" 1/4" spade terminal is provided on the furnace integrated control. Any electronic air cleaner or other 120V accessory rated up to **one amp** can be connected to this terminal with the neutral leg of the circuit being connected to one of the provided neutral terminals. See Figure 45 for location of terminal. This terminal is energized when the indoor blower is operating.

8. One line voltage “HUM” 1/4” spade terminal is provided on the furnace integrated control. Any humidifier or other 120V accessory rated up to **one amp** can be connected to this terminal with the neutral leg of the circuit being connected to one of the provided neutral terminals. See Figure 41 for location of terminal. This terminal is energized in the heating mode when the indoor blower is operating.
9. One 24V “H” terminal is provided on the furnace integrated control terminal block. Any humidifier rated up to 0.5 amp can be connected to this terminal with the ground leg of the circuit being connected to either ground or the “C” terminal. See Figure 41 for location of terminal.
10. Install the room thermostat according to the instructions provided with the thermostat. See Table 11 for thermostat connections. If the furnace is being matched with a heat pump, refer to the instruction packaged with the dual fuel thermostat.

Run Length – Non Communicating

Wire Run Length	AWG#	Insulation / Core Types
Less than 100' (30 m)	18	Color coded, temperature rating 95° F (35° C) minimum, solid core. (Class II Rated Wiring)
More than 100' (30 m)	16	

Table 9

Thermostat Selection

A Confort Sync™ thermostat must be used in communicating applications. Refer to the instructions provided with the thermostat for installation, set-up and operation.

This unit is designed to operate in a variable rate capacity mode using a two-stage thermostat. This unit will automatically adjust firing rate based upon thermostat cycle times.

For optimal performance use a high quality electronic digital thermostat or any other with adjustable settings for 1st stage / 2nd stage on / off differentials and adjustable stage timers.

The following is a two-stage thermostat setup for optimal variable rate capacity mode:

First heat stage differential set to 1/2 to 1° F; second heat stage differential set to 1/2 or 1° F; second heat stage upstage timer disabled, or set to maximum (1 hr. minimum).

NOTE - When the furnace is used with a Comfort Sync™ thermostat, proper indoor blower speed selections are made by the communicating thermostat.

Indoor Blower Speeds

1. When the thermostat is set to “FAN ON”, the indoor blower will run continuously at approximately 38% of the second stage cooling speed when there is no cooling or heating demand.
2. When the unit is running in the heating mode, the integrated control will automatically adjust the blower speed to match the furnace firing rate. This speed can be adjusted up or down by 7.5% or 15% using DIP switches 14 through 16 for the low heat speed and 17 through 19 for the high heat speed.
3. When there is a cooling demand, the indoor blower will run on the cooling speed designated by the positions of DIP switches 8 through 11.

Generator Use - Voltage Requirements

The following requirements must be kept in mind when specifying a generator for use with this equipment:

- The furnace requires 120 volts ± 10% (Range: 108 volts to 132 volts).
- The furnace operates at 60 Hz ± 5% (Range: 57 Hz to 63 Hz).
- The furnace integrated control requires both polarity and proper ground. Both polarity and proper grounding should be checked before attempting to operate the furnace on either permanent or temporary power.
- Generator should have a wave form distortion of less than 5% THD (total harmonic distortion).

Typical A97USMV Field Wiring Diagram for Standard Non-Communicating Thermostat

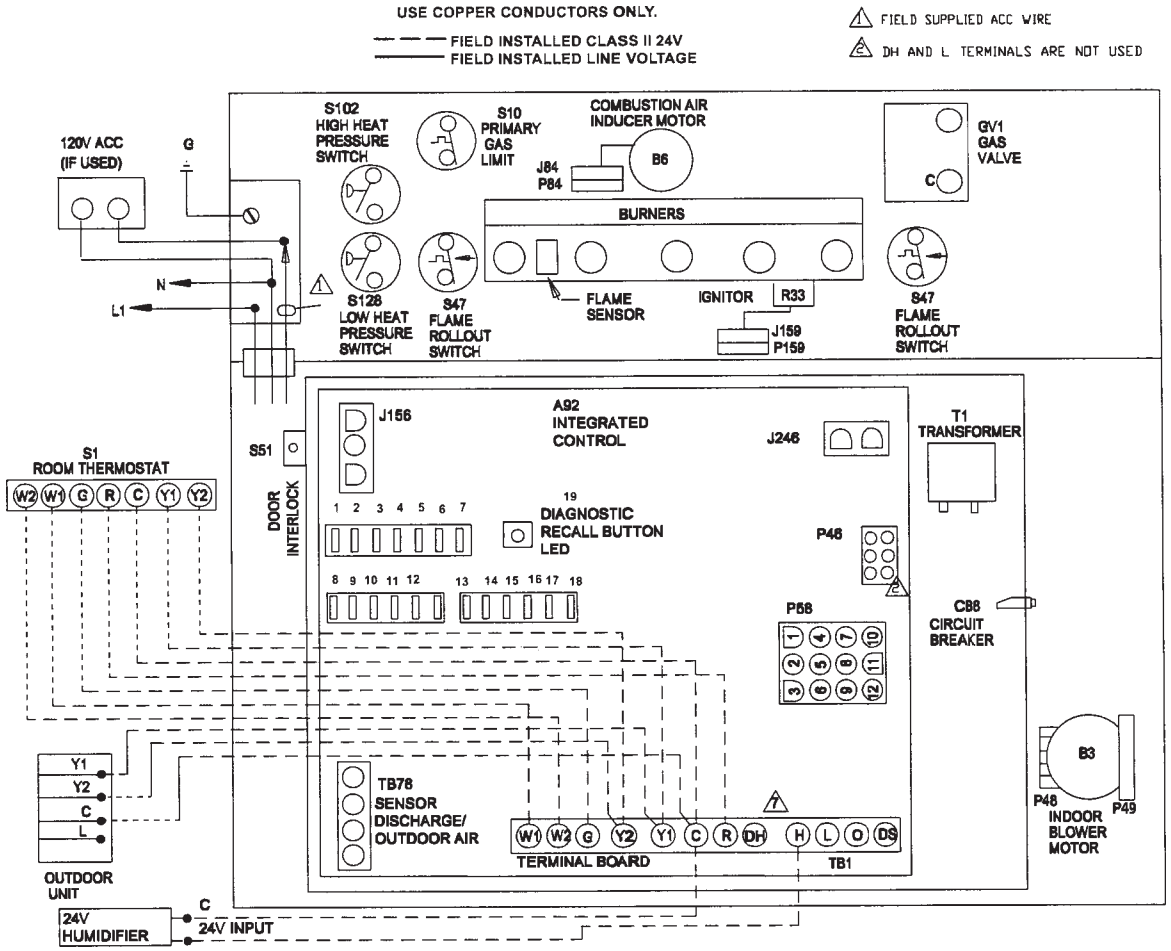


Figure 44

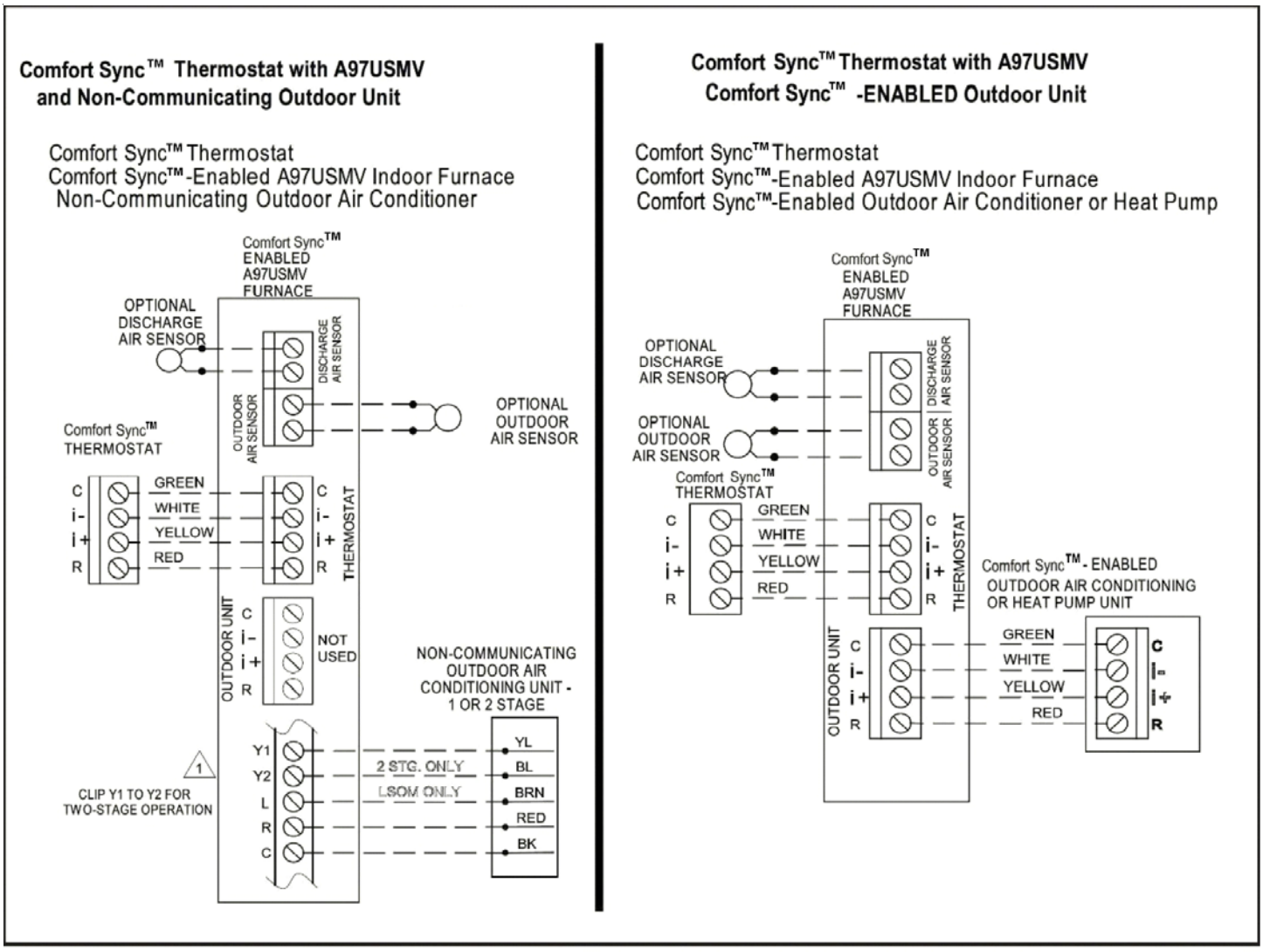

Comfort Sync™ Thermostat with A97USMV and Non-Communicating Outdoor Unit
Comfort Sync™ Thermostat
Comfort Sync™-Enabled A97USMV Indoor Furnace
Non-Communicating Outdoor Air Conditioner
Comfort Sync™ ENABLED A97USMV FURNACE
OPTIONAL DISCHARGE AIR SENSOR
DISCHARGE AIR SENSOR
OUTDOOR AIR SENSOR
OPTIONAL OUTDOOR AIR SENSOR
Comfort Sync™ THERMOSTAT
C
i-
i+
R
GREEN
WHITE
YELLOW
RED
THERMOSTAT
OUTDOOR UNIT
NOT USED
NON-COMMUNICATING OUTDOOR AIR CONDITIONING UNIT - 1 OR 2 STAGE
Y1
Y2
L
R
C
2 STG. ONLY
1SOM ONLY
YL
BL
BRN
RED
BK
1
CLIP Y1 TO Y2 FOR TWO-STAGE OPERATION
Comfort Sync™ Thermostat with A97USMV
Comfort Sync™ -ENABLED Outdoor Unit
Comfort Sync™ Thermostat
Comfort Sync™-Enabled A97USMV Indoor Furnace
Comfort Sync™-Enabled Outdoor Air Conditioner or Heat Pump
Comfort Sync™ ENABLED A97USMV FURNACE
OPTIONAL DISCHARGE AIR SENSOR
DISCHARGE AIR SENSOR
OPTIONAL OUTDOOR AIR SENSOR
OUTDOOR AIR SENSOR
Comfort Sync™ THERMOSTAT
C
i-
i+
R
GREEN
WHITE
YELLOW
RED
THERMOSTAT
OUTDOOR UNIT
Comfort Sync™ - ENABLED OUTDOOR AIR CONDITIONING OR HEAT PUMP UNIT

Figure 45

Optional Accessories for use with any Comfort Sync™ System

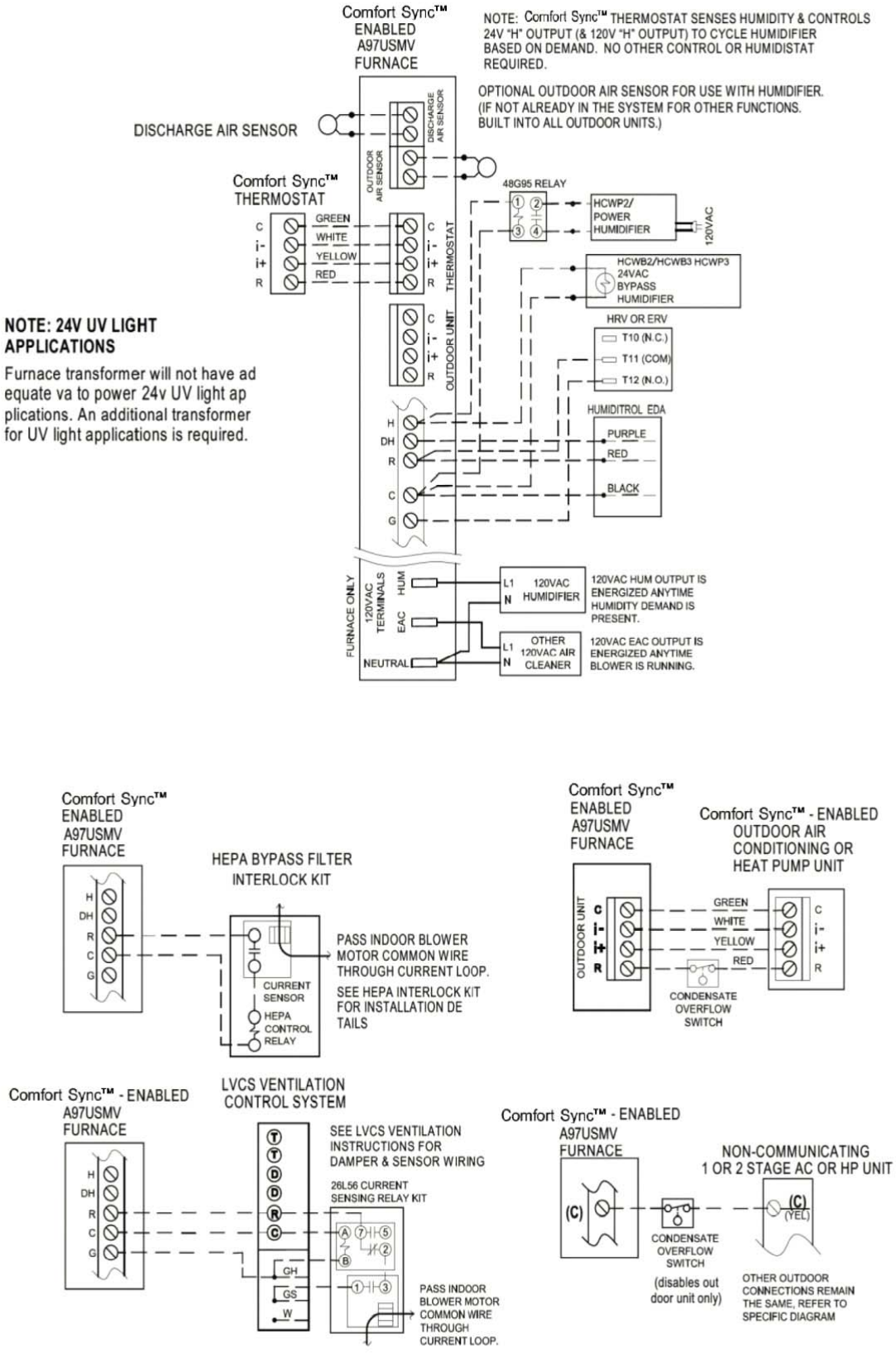
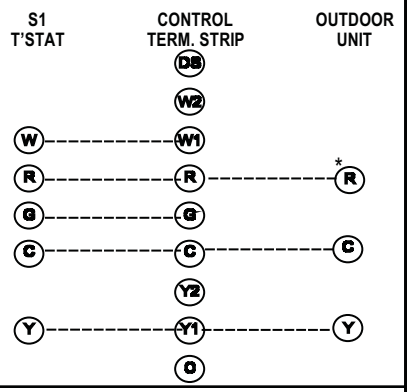
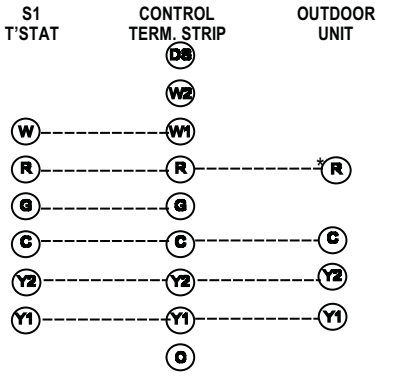
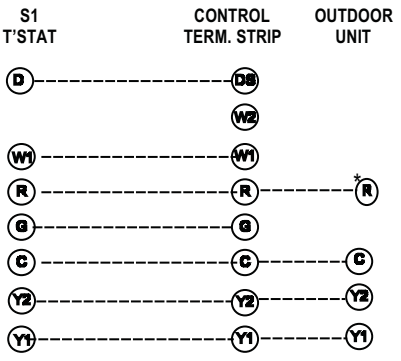

Comfort Sync™ ENABLED A97USMV FURNACE
NOTE: Comfort Sync™ THERMOSTAT SENSES HUMIDITY & CONTROLS 24V "H" OUTPUT (& 120V "H" OUTPUT) TO CYCLE HUMIDIFIER BASED ON DEMAND. NO OTHER CONTROL OR HUMIDISTAT REQUIRED.
OPTIONAL OUTDOOR AIR SENSOR FOR USE WITH HUMIDIFIER. (IF NOT ALREADY IN THE SYSTEM FOR OTHER FUNCTIONS. BUILT INTO ALL OUTDOOR UNITS.)
DISCHARGE AIR SENSOR
Comfort Sync™ THERMOSTAT
GREEN
WHITE
YELLOW
RED
48G95 RELAY
HCWP2/ POWER HUMIDIFIER
120VAC
HCWB2/HCWB3 HCWP3 24VAC BYPASS HUMIDIFIER
HRV OR ERV
T10 (N.C.)
T11 (COM)
T12 (N.O.)
HUMIDITROL EDA
PURPLE
RED
BLACK
NOTE: 24V UV LIGHT APPLICATIONS
Furnace transformer will not have ad equate va to power 24v UV light ap plications. An additional transformer for UV light applications is required.
FURNACE ONLY 120VAC TERMINALS
HUM
EAC
NEUTRAL
120VAC HUMIDIFIER
120VAC HUM OUTPUT IS ENERGIZED ANYTIME HUMIDITY DEMAND IS PRESENT.
OTHER 120VAC AIR CLEANER
120VAC EAC OUTPUT IS ENERGIZED ANYTIME BLOWER IS RUNNING.
Comfort Sync™ ENABLED A97USMV FURNACE
HEPA BYPASS FILTER INTERLOCK KIT
CURRENT SENSOR
HEPA CONTROL RELAY
PASS INDOOR BLOWER MOTOR COMMON WIRE THROUGH CURRENT LOOP.
SEE HEPA INTERLOCK KIT FOR INSTALLATION DE TAILS
Comfort Sync™ ENABLED A97USMV FURNACE
Comfort Sync™ - ENABLED OUTDOOR AIR CONDITIONING OR HEAT PUMP UNIT
CONDENSATE OVERFLOW SWITCH
Comfort Sync™ - ENABLED A97USMV FURNACE
LVCS VENTILATION CONTROL SYSTEM
SEE LVCS VENTILATION INSTRUCTIONS FOR DAMPER & SENSOR WIRING
26L56 CURRENT SENSING RELAY KIT
PASS INDOOR BLOWER MOTOR COMMON WIRE THROUGH CURRENT LOOP.
Comfort Sync™ - ENABLED A97USMV FURNACE
NON-COMMUNICATING 1 OR 2 STAGE AC OR HP UNIT
CONDENSATE OVERFLOW SWITCH
(disables out door unit only)
OTHER OUTDOOR CONNECTIONS REMAIN THE SAME, REFER TO SPECIFIC DIAGRAM

Figure 46

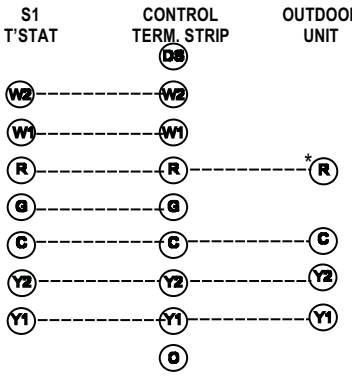
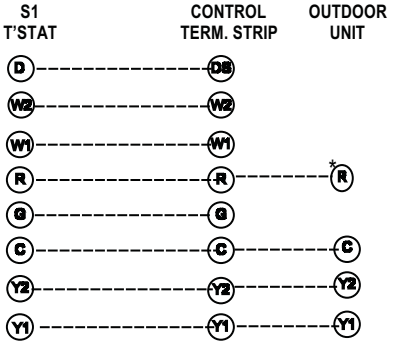
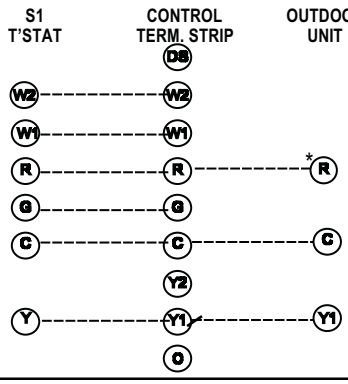
Field Wiring Connections for Non-Communicating Thermostat Applications

Thermostat	DIP Switch Settings and On-Board Links				Wiring Connections
	DIP Switch 1	W915 (Y1 to Y2) Two-Stage Cooling	W914 (DS to R) Dehumidification or Harmony III™	W951 (O to R) Heat Pumps	
1Heat / 1 Cool *NOTE - Use DIP switch 3 to set second-stage heat ON delay. OFF-7 minutes. ON-12 minutes.*	ON	Intact	Intact	Intact	
1 Heat / 2 Cool *NOTE - Use DIP switch 3 to set second-stage heat ON delay. OFF-7 minutes. ON-12 minutes.*	ON	Cut	Intact	Intact	
1 Heat / 2 Cool with t'stat with dehumidification mode *NOTE - Use DIP switch 3 to set second-stage heat ON delay. OFF-7 minutes. ON-12 minutes.*	ON	Cut	Cut	Intact	

"R" required on some units.

Table 12A

Field Wiring for Non-Communicating Applications (continued)

Thermostat	DIP Switch Settings and On-Board Links				Wiring Connections
	DIP Switch 1	W915 (Y1 to Y2) Two-Stage Cooling	W914 (DS to R) Dehumidification or Harmony III™	W951 (O to R) Heat Pumps	
2 Heat / 2 Cool	OFF	Cut	Intact	Intact	
2 Heat / 2 Cool with t'stat with dehumidification mode	OFF	Cut	Cut	Intact	
2 Heat / 1 Cool	OFF	Intact	Intact	Intact	

* "R" required on some units.

Table 12B

Field Wiring for Non-Communicating Applications (continued)

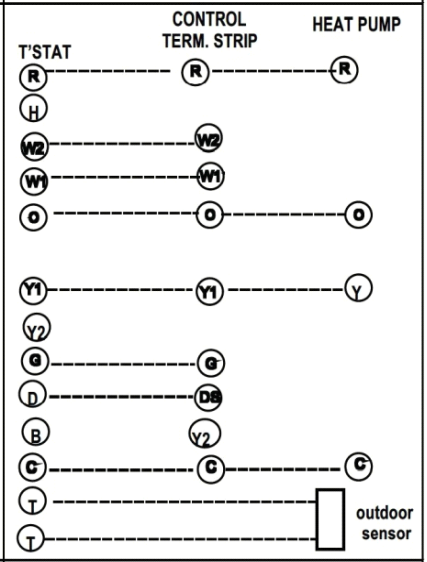
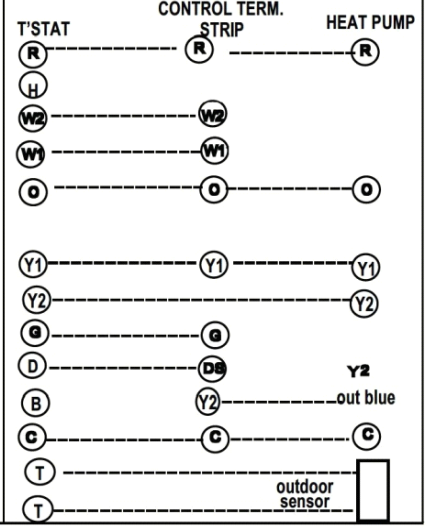
Thermostat	DIP Switch Settings and On-Board Links				Wiring Connections
	DIP Switch	W915 (Y1 to Y2) Two-Stage Cooling	W914 (DS to R) Dehumidification or Harmony III™	W951 (O to R) Heat Pumps	
Dual Fuel Single-Stage Heat Pump thermostat w/ dual fuel capabilities Capable of 2-stage gas heat control	DIP Switch 1 OFF	Intact	Intact	Cut	
Dual Fuel Two Stage Heat Pump thermostat w/ dual fuel capabilities Capable of 2-stage gas heat control	DIP Switch 1 OFF	Cut	Intact	Cut	

Table 12C

Typical A97USMV Wiring Diagram

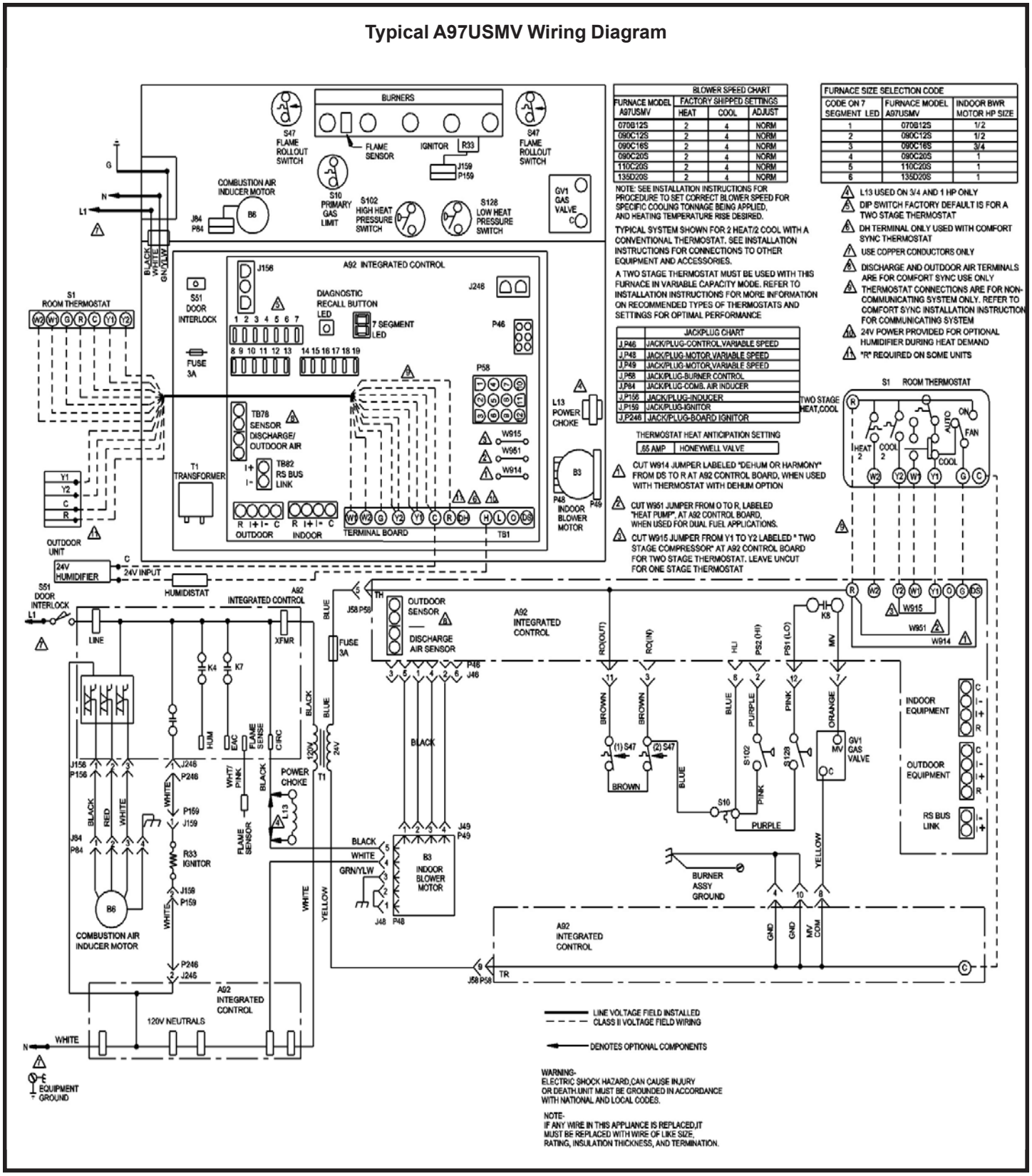
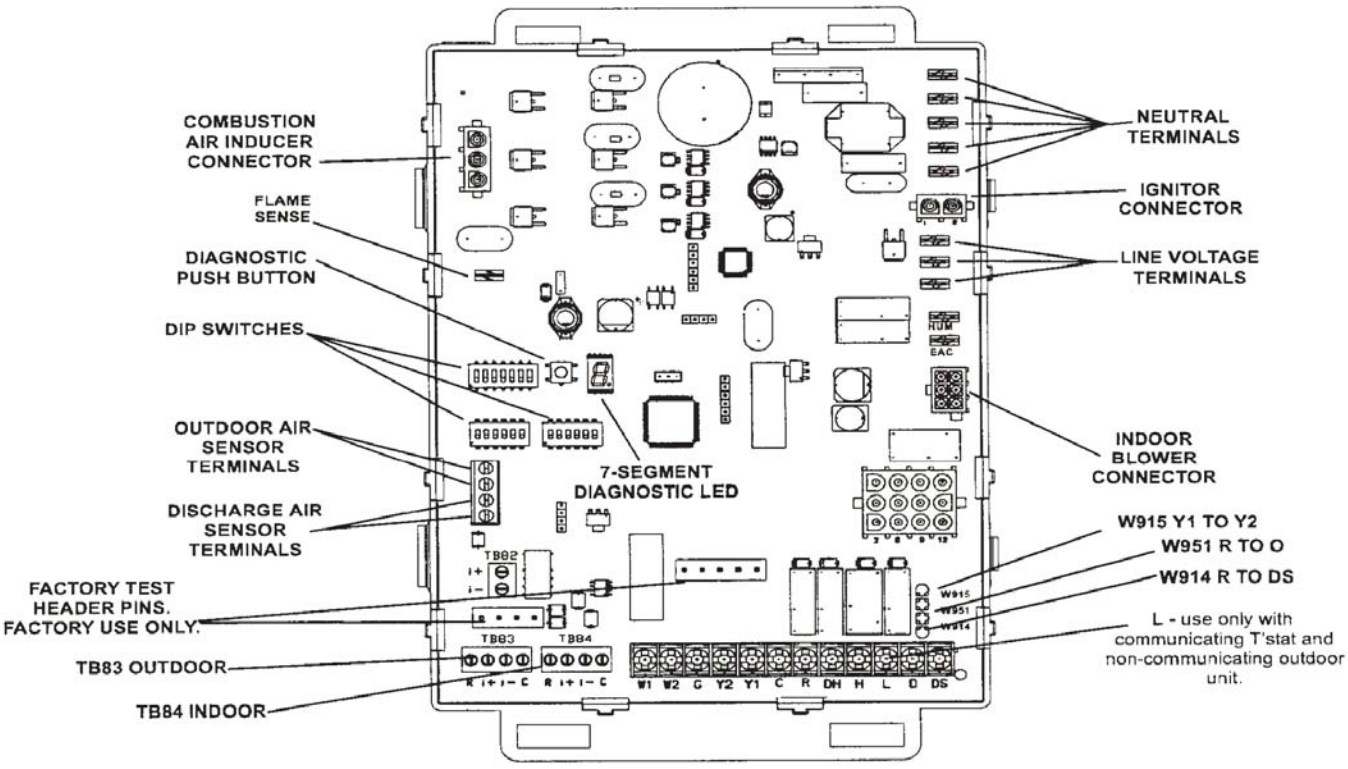


Figure 47



RS-BUS OUTDOOR (TB83)

R = 24VAC
I + = DATA HIGH CONNECTION
I - = DATA LOW CONNECTION
C = 24VAXC COMMON

RS-BUS INDOOR (TB84)

R = 24VAC
I + = DATA HIGH CONNECTION
I - = DATA LOW CONNECTION
C = 24VAXC COMMON

1/4" QUICK CONNECT TERMINALS

HUM = 120 VAC OUTPUT TO HUMIDIFIER
XMFR = 120 VAC OUTPUT TO TRANSFORMER

LI = 120 VAC INPUT TO CONTROL

CIRC = 120 VAC OUTPUT TO CIRCULATING BLOWER

EAC = 120 VAC OUTPUT TO ELECTRICAL AIR CLEANER

NEUTRALS = 120 VAC NEUTRAL

THERMOSTAT CONNECTIONS (TB1)

W1 = 1ST STAGE HEAT DEMAND FROM T/STAT

W2 = 2ND STAGE HEAT DEMAND FROM T/STAT

G = MANUAL FAN FROM T'STAT

Y2 = 2ND STAGE COOL SIGNAL FROM THERMOSTAT

Y1 = 1ST STAGE COOL SIGNAL FROM THERMOSTAT

C = THERMOSTAT SIGNAL GROUND CONNECTED TO TRANSFORMER GRD (TR) & CHASIS GROUND (GRD)

R = 24V TO THERMOSTAT

DH = DEHUMIDIFICATION OUTPUT COMMUNICATING THERMOSTAT ONLY

H = 24V HUMIDIFIER OUTPUT. DO NOT CONNECT TO THERMOSTAT

L = USE ONLY WITH A COMMUNICATING THERMOSTAT AND A NON-COMMUNICATING OUTDOOR UNIT

O = THERMOSTAT SIGNAL TO HEAT PUMP REVERSING VALVE

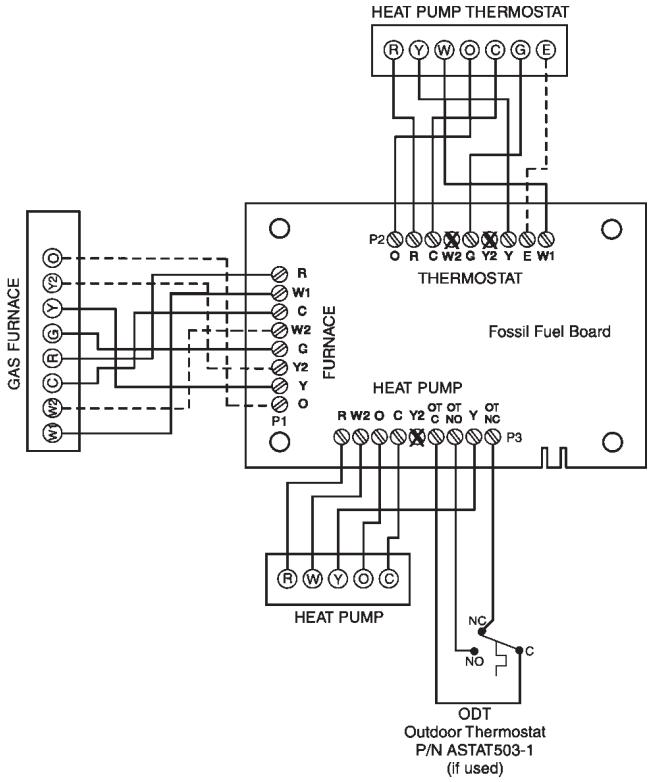
DS = DEHUMIDIFICATION SIGNAL

Figure 48

Low Voltage Field Wiring

Single Stage

Thermostat	DIP Switch Settings & On Board Links (Figure 41)			
	DIP Switch	W915 (Y1 to Y2) Two Stage Cooling	W914 (DS to R) Dehumidification	W951 (O to R) Heat Pumps
Dual Fuel Single Stage Heat Pump thermostat w/dual fuel capabilities Capable of 2 stage gas heat control	DIP Switch 1 OFF	Intact	Intact	Cut



2 Stage

Thermostat	DIP Switch Settings & On Board Links (Figure 41)			
	DIP Switch	W915 (Y1 to Y2) Two Stage Cooling	W914 (DS to R) Dehumidification	W951 (O to R) Heat Pumps
Dual Fuel Two Stage Heat Pump thermostat w/dual fuel capabilities Capable of 2 stage gas heat control	DIP Switch 1 OFF	Cut	Intact	Cut

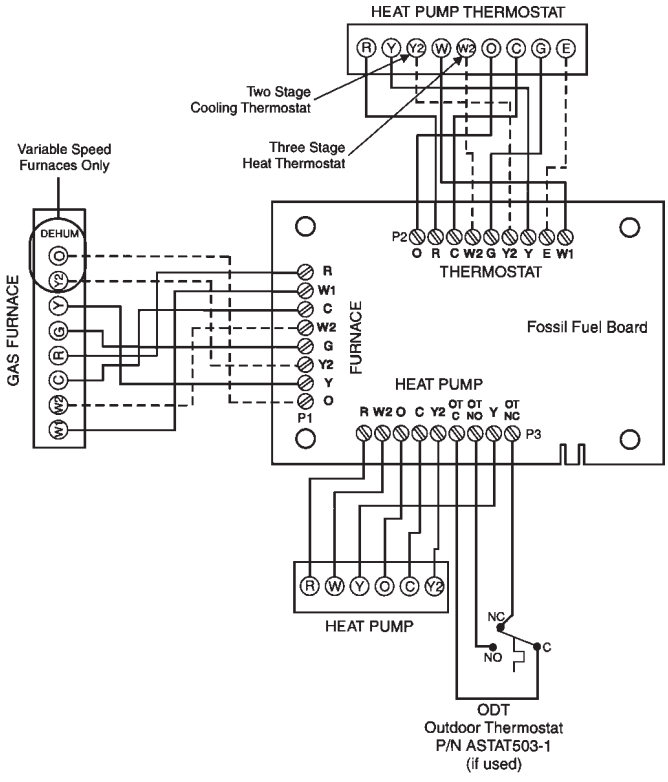


Table 14

Thermostat Selection Switch Settings

Operation	Thermostat	Switch 1	Switch 2	Switch 3
Variable Capacity Heat (40% to 100%)	Two Stage	OFF	ON	OFF
Three Stage Heat (40%, 70%, 100%)	Single Stage	ON	OFF	2nd stage delay OFF = 7 minutes ON = 12 minutes 3rd stage delay 10 minutes fixed
Two Stage Heat (W1 70%, W2 100%)	Two Stage	OFF	OFF	OFF

Table 15

NOTE - When this furnace is used with a Comfort Sync™ communicating thermostat, all indoor blower speed selections and DIP switch settings are made by the communicating thermostat.

These units are equipped with an integrated control. This control manages ignition timing, combustion air inducer speed, heating mode fan OFF delays and indoor blower speeds based on selections made using the control DIP switches and onboard links. The control includes an internal feature which automatically resets the ignition control when it has been locked out.

NOTE: *All DIP switches are factory shipped in the "OFF" position.*

Heating Operation DIP Switch Settings - Figure 41

Switch 1 - Thermostat Selection - This unit may be used with either a single stage or two stage thermostat. The thermostat selection is made using a DIP switch which must be properly positioned for the particular application. The DIP switch is factory positioned for use with a two stage thermostat. If a single stage thermostat is to be used, the DIIP switch must be repositioned. See Table 12.

Switch 2 - Operating Mode with Two Stage Thermostat If a two stage thermostat is used, the furnace can operate in either variable capacity or conventional two stage mode. When variable capacity mode is selected, the firing rate of the unit is varied to maximize comfort. Conventional two stage mode is the factory default setting. See Table 12.

Switch 3 - Second Stage Heat On Delay - If a single stage thermostat is used, the integrated control can be used to energize second stage heat after either 7 minutes or 12 minutes of first stage heat operation. See Table 12.

Switches 4 and 5 - Blower Off Delay -The blower On delay of 30 seconds is not adjustable. The blower Off delay (time that the blower operates after the heating demand has been satisfied) can be adjusted by moving switches 4 and 5 on the integrated control. The unit is shipped from the factory with a blower Off delay of 90 seconds. The blower Off delay affects comfort and is adjustable to satisfy individual applications. Adjust the blower Off delay to achieve a supply air temperature between 90° and 110° F at the exact moment that the blower is de-energized. Longer Off delay settings provide lower supply air temperatures; shorter settings provide higher supply air temperatures. Table 13 provides the blower Off timings that will result from different switch settings.

Blower Off Delay Switch Settings

Blower Off Delay (Seconds)	Switch 4	Switch 5
60	Off	On
90 (factory)	Off	Off
120	On	Off
180	On	On

Table 16

Indoor Blower Operation DIP Switch Settings

Switches 6 and 7 - Continuous Indoor Fan Operation - Blower Speed - The unit is shipped from the factory with the DIP switches positioned for medium low (38%) speed during continuous indoor blower operation. Continuous fan setting is 38% of cool setting and is not adjustable.

Switches 8 and 9 - Cooling Mode Blower Speed- The unit is shipped from the factory with the DIP switches positioned for high speed (4) indoor blower motor operation during the cooling mode. The table below provides the cooling mode blower speeds that will result from different switch settings.

Cooling Mode Blower Speeds

Speed	Switch 8	Switch 9
1 - Low	On	On
2 - Medium Low	Off	On
3 - Medium High	On	Off
4 - High (Factory)	Off	Off

Table 17

Switches 10 and 11 - Cooling Mode Blower Speed Adjustment - The unit is shipped from the factory with the DIP switches positioned for NORMAL (no) adjustment. The DIP switches may be positioned to adjust the blower speed by +10% or -10% to better suit the application. Table 18 provides blower speed adjustments that will result from different switch settings. Refer to air flow tables for values.

With switches 10 an 11 set to ON, motor will bypass ramping profiles and all delays and will immediately run at selected COOLING speed upon a call for cool. LED will continue to operate as normal. This mode is used to check motor operation.

Cooling Mode Blower Speed Adjustment

Adjustment	Switch 10	Switch 11
+ 10% (approx.)	On	Off
NORMAL (Factory)	Off	Off
- 10% (approx.)	Off	On
MOTOR TEST	On	On

Table 18

Switches 12 and 13 - Cooling Mode Blower Speed Ramping - Blower speed ramping may be used to enhance dehumidification performance. The switches are factory set at option A which has the greatest effect on blower motor performance. Table 19 provides the cooling mode blower speed ramping options that will result from different switch settings. The cooling mode blower speed ramping options are detailed below.

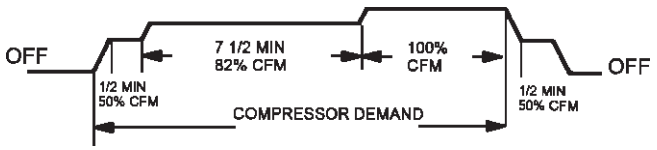
NOTE: *The OFF portion of the selected ramp profile only applies during heat pump operation in dual fuel applications.*

Cooling Mode Blower Speed Ramping

Ramping Option	Switch 12	Switch 13
A (Factory)	Off	Off
B	On	Off
C	Off	On
D	On	On

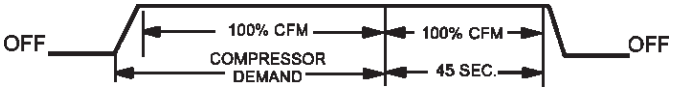
Table 19

Ramping Option "A" (Factory Selection)
- Motor runs at 50% for 30 seconds.
- Motor then runs at 82% for approximately 7-1/2 minutes.
- If demand has not been satisfied after 7-1/2 minutes, motor runs at 100% until demand is satisfied.
- Once demand is met, motor runs at 50% for 30 seconds then ramps down to stop.

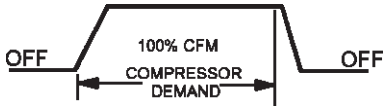


Ramping Option "B"
- Motor runs at 82% for approximately 7-1/2 minutes. If demand has not been satisfied after 7-1/2 minutes, motor runs at 100% until demand is satisfied.
- Once demand is met, motor ramps down to stop.

Ramping Option "C"
- Motor runs at 100% until demand is satisfied.
- Once demand is met, motor runs at 100% for 45 seconds then ramps down to stop.



Ramping Option "D"
- Motor runs at 100% until demand is satisfied.
- Once demand is met, motor ramps down to stop.



Switches 14 through 19 - Heating Mode Blower Speed
These switches are factory set at the OFF position which provides 100% of normal speed during HIGH HEAT demand, 70% of normal speed during MIDRANGE HEAT demand and 40% of normal speed during LOW HEAT demand. Switches 14, 15 and 16 are used to adjust the LOW HEAT blower motor speed. Switches 17, 18 and 19 are used to adjust the HIGH HEAT blower motor speed. Table 18 provides the heating mode blower speeds that will result from different switch settings.

Low Heat Blower Speeds

Thermostat Demand	Blower Speed Adjustments	DIP SWITCH SETTINGS		
		14	15	16
Low Heat (R to W1)	+ 15%	On	Off	On
	+7.5%	On	Off	Off
	Normal	Off	Off	Off
	-7.5%	On	On	Off
	-15%	On	On	On

Table 20

High Heat Blower Speeds

Thermostat Demand	Blower Speed Adjustments	DIP SWITCH SETTINGS		
		17	18	19
High Heat (R to W1 & W2)	+15%	On	Off	On
	+7.5%	On	Off	Off
	Normal	Off	Off	Off
	-7.5%	On	On	Off
	-15%	On	On	On

Table 21

On Board Links
On Board links must be clipped (when applicable) before unit is placed into operation with a non-communicating thermostat.

On Board Link W914 DS to R
On Board link W914, is a clippable connection between terminals DS and R on the integrated control. W914 must be cut when installed with a thermostat which features humidity control. Refer to Table 22 for operation sequence in applications for this unit, a thermostat which features humidity control and a single speed outdoor unit. Table 23 gives the operation sequence in applications with a two speed outdoor unit.

On Board Link W951 R to O
On Board link W951 is a clippable connection between terminals R and O on the integrated control. W951 must be cut when the furnace is installed in applications which include a heat pump unit and thermostat which features dual fuel use. If the link is left intact, terminal "O" will remain energized eliminating the HEAT MODE in the heat pump.

On Board Link W915 Y1 to Y2
On Board link W915 is a clippable connection between terminals Y1 and Y2 on the integrated control. W915 must be cut if two stage cooling will be used. If the link is not cut the outdoor unit will operate in second stage cooling only.

Diagnostic LED
The seven segment diagnostic LED displays operating status, target airflow, error codes and other information. The table on page 58 lists diagnostic LED codes.

Diagnostic Push Button
The diagnostic push button is located adjacent to the seven segment diagnostic LED. This button is used to enable the Error Code Recall mode and the Field Test mode. Press the button and hold it to cycle through a menu of options. Every five seconds a new menu item will be displayed. When the button is released, the displayed item will be selected. Once all items in the menu have been displayed, the menu resumes from the beginning until the button is released.

Error Code Recall Mode
Select "E" from the menu to access the most recent 10 error codes. Select "c" from the Error Code Recall menu to clear all error codes. Button must be pressed a second time while "c" is flashing to confirm command to delete codes. Press the button until a solid "☰" is displayed to exit the Error Code Recall mode.

Field Test Mode
Use the diagnostic push button to scroll through the menu as described above. Release the button when the LED flashes "-" to select the Field Test mode.

While in the Field Test mode the technician can:
- Initiate furnace ignition and move to and hold low-fire rate by applying a R to W1 jumper.
- Initiate furnace ignition sequence and move to an hold high-fire rate by applying a jumper from R to W1 and W2.
- Initiate furnace ignition sequence and move to and hold mid-fire rate by applying a jumper to R and W2.
- Apply then remove the jumper from R to W1 and W2 to change the firing rate from low fire to mid fire and high fire.
- A vent calibration sequence can be initiated even if a thermostat signal is not present. Press and hold the push button until a solid "C" is displayed. Release the button and calibration will begin. The furnace will perform the high-fire and low-fire pressure switch calibrations and display "CAL". After calibration , the LED will return to the flashing "-" display.

During Field Test mode operation, all safety switches are still in the circuit (they are not by-passed) and indoor blower performance and timings will match DIP switch selections. Current furnace firing rate, indoor blower CFM and flame signal will be displayed. To exit the Field Test mode, press and hold the button. The menu will resume from the beginning. Also, cycle the main power to exit the Field Test mode. The integrated control will automatically exit the Field Test mode after 45 minutes of operation

BLOWER DATA

A97USMV070B12S BLOWER PERFORMANCE (less filter)

BOTTOM RETURN AIR

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	538	636	735	833	931	1030	1128
Increase (+7.5%) Heat CFM	496	588	680	772	864	956	1048
Default Heat CFM	453	539	624	710	796	881	967
Decrease (-7.5%) Heat CFM	419	498	578	657	736	815	895
Decrease (-15%) Heat CFM	385	458	531	604	676	749	822

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	600	740	840	970	860	1060	1215	1365
Default Cool CFM	555	665	770	855	810	960	1130	1265
Decrease (-10%) Cool CFM	500	600	680	790	705	840	1005	1140

A97USMV070B12S BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	531	625	718	812	906	999	1093
Increase (+7.5%) Heat CFM	490	579	667	756	845	933	1022
Default Heat CFM	449	533	616	700	784	867	951
Decrease (-7.5%) Heat CFM	413	487	561	635	709	783	857
Decrease (-15%) Heat CFM	378	442	506	571	635	699	763

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	590	705	805	955	840	1050	1205	1355
Default Cool CFM	540	640	725	820	750	945	1130	1230
Decrease (-10%) Cool CFM	500	580	665	720	685	805	990	1110

The effect of static pressure is included in air volumes shown.
The following control configurations are available. See Installation Instructions for details and DIP switch settings.

Heat Modes Available (Heating Blower Performance Table):

Single stage thermostat:
- 40%, 70%, 100% input (three-stage) with time delays in-between

Two-stage thermostat:
- Variable Rate Capacity Mode - furnace automatically adjusts firing rate based on first- and second-stage cycle times
- W1 demand at 70% input, W2 demand at 100% input. No delay between stages

Cool Mode Available (Cooling Blower Performance table):

First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
Continuous Fan speeds are approximately 38% of the same second-stage COOL speed position minimum 300 cfm.

BLOWER DATA

A97USMV070B12S BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR WITH OPTIONAL RETURN AIR BASE

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	519	614	709	805	900	996	1091
Increase (+7.5%) Heat CFM	480	570	660	751	841	931	1021
Default Heat CFM	441	526	611	696	781	866	951
Decrease (-7.5%) Heat CFM	408	486	564	643	721	799	877
Decrease (-15%) Heat CFM	375	446	517	589	660	732	803

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	595	715	815	950	855	1045	1205	1350
Default Cool CFM	520	655	755	840	790	945	1090	1255
Decrease (-10%) Cool CFM	490	595	670	745	720	845	985	1130

A97USMV070B12S BLOWER PERFORMANCE (less filter)

BOTTOM RETURN AIR

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	734	827	921	1014	1108	1201	1295
Increase (+7.5%) Heat CFM	697	782	867	953	1038	1123	1209
Default Heat CFM	660	737	814	891	968	1045	1122
Decrease (-7.5%) Heat CFM	616	687	757	828	899	970	1041
Decrease (-15%) Heat CFM	572	637	701	766	830	895	959

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	625	710	830	950	875	1040	1210	1360
Default Cool CFM	565	670	760	860	800	945	1100	1240
Decrease (-10%) Cool CFM	520	610	685	785	720	840	970	1115

The effect of static pressure is included in air volumes shown.
The following control configurations are available. See Installation Instructions for details and DIP switch settings.

Heat Modes Available (Heating Blower Performance Table):

Single stage thermostat:
- 40%, 70%, 100% input (three-stage) with time delays in-between

Two-stage thermostat:
- Variable Rate Capacity Mode - furnace automatically adjusts firing rate based on first- and second-stage cycle times
- W1 demand at 70% input, W2 demand at 100% input. No delay between stages

Cool Mode Available (Cooling Blower Performance table):

First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
Continuous Fan speeds are approximately 38% of the same second-stage COOL speed position minimum 300 cfm.

BLOWER DATA

A97USMV090C12S BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	702	792	881	971	1061	1150	1240
Increase (+7.5%) Heat CFM	673	757	841	926	1010	1094	1178
Default Heat CFM	644	723	802	880	959	1037	1116
Decrease (-7.5%) Heat CFM	608	676	745	814	882	951	1020
Decrease (-15%) Heat CFM	571	630	689	747	806	864	923

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	610	705	795	920	840	1015	1165	1300
Default Cool CFM	560	640	715	810	770	910	1050	1190
Decrease (-10%) Cool CFM	525	605	665	725	695	795	945	1110

A97USMV090C12S BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR WITH OPTIONAL RETURN AIR BASE

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	721	810	899	988	1076	1165	1254
Increase (+7.5%) Heat CFM	679	760	842	923	1004	1085	1167
Default Heat CFM	637	711	784	858	932	1005	1079
Decrease (-7.5%) Heat CFM	606	673	740	806	873	939	1006
Decrease (-15%) Heat CFM	576	635	695	754	814	873	933

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	605	715	810	930	850	995	1165	1305
Default Cool CFM	570	660	735	820	775	905	1050	1205
Decrease (-10%) Cool CFM	530	600	670	725	710	800	945	1070

The effect of static pressure is included in air volumes shown.
The following control configurations are available. See Installation Instructions for details and DIP switch settings.

Heat Modes Available (Heating Blower Performance Table):

Single stage thermostat:
- 40%, 70%, 100% input (three-stage) with time delays in-between

Two-stage thermostat:
- Variable Rate Capacity Mode - furnace automatically adjusts firing rate based on first- and second-stage cycle times
- W1 demand at 70% input, W2 demand at 100% input. No delay between stages

Cool Mode Available (Cooling Blower Performance table):

First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
Continuous Fan speeds are approximately 38% of the same second-stage COOL speed position minimum 300 cfm.

BLOWER DATA

A97USMV090C16S BLOWER PERFORMANCE (less filter)

BOTTOM RETURN AIR

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	835	968	1101	1234	1367	1500	1633
Increase (+7.5%) Heat CFM	776	902	1028	1155	1281	1407	1534
Default Heat CFM	716	836	955	1075	1195	1314	1434
Decrease (-7.5%) Heat CFM	652	767	882	997	1112	1227	1342
Decrease (-15%) Heat CFM	589	699	809	919	1029	1139	1249

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	840	1005	1155	1315	1165	1375	1580	1770
Default Cool CFM	780	915	1045	1190	1075	1265	1440	1645
Decrease (-10%) Cool CFM	690	835	955	1070	935	1145	1320	1465

A97USMV090C16S BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	812	943	1073	1204	1334	1465	1595
Increase (+7.5%) Heat CFM	759	882	1005	1127	1250	1372	1495
Default Heat CFM	706	821	936	1051	1165	1280	1395
Decrease (-7.5%) Heat CFM	644	755	867	978	1089	1200	1312
Decrease (-15%) Heat CFM	582	690	797	905	1013	1120	1228

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	820	1005	1135	1290	1140	1340	1525	1725
Default Cool CFM	755	880	1025	1150	1040	1235	1395	1565
Decrease (-10%) Cool CFM	680	815	925	1065	910	1120	1275	1400

The effect of static pressure is included in air volumes shown.
The following control configurations are available. See Installation Instructions for details and DIP switch settings.

Heat Modes Available (Heating Blower Performance Table):

Single stage thermostat:
- 40%, 70%, 100% input (three-stage) with time delays in-between

Two-stage thermostat:
- Variable Rate Capacity Mode - furnace automatically adjusts firing rate based on first- and second-stage cycle times
- W1 demand at 70% input, W2 demand at 100% input. No delay between stages

Cool Mode Available (Cooling Blower Performance table):

First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
Continuous Fan speeds are approximately 38% of the same second-stage COOL speed position minimum 300 cfm.

BLOWER DATA

A97USMV090C16S BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR WITH OPTIONAL RETURN AIR BASE

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	828	956	1084	1213	1341	1469	1597
Increase (+7.5%) Heat CFM	766	888	1010	1132	1255	1377	1499
Default Heat CFM	703	819	936	1052	1168	1285	1401
Decrease (-7.5%) Heat CFM	650	762	874	986	1099	1211	1323
Decrease (-15%) Heat CFM	596	704	812	921	1029	1137	1245

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	840	955	1120	1280	1160	1360	1530	1740
Default Cool CFM	775	910	1010	1170	1060	1240	1400	1590
Decrease (-10%) Cool CFM	695	815	930	1045	925	1130	1295	1440

A97USMV090C20S BLOWER PERFORMANCE (less filter)

BOTTOM RETURN AIR

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	665	830	995	1159	1324	1488	1653
Increase (+7.5%) Heat CFM	618	774	930	1085	1241	1397	1553
Default Heat CFM	571	718	865	1012	1159	1306	1453
Decrease (-7.5%) Heat CFM	507	644	781	917	1054	1191	1328
Decrease (-15%) Heat CFM	443	570	697	823	950	1076	1203

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	933	1054	1274	1466	1385	1593	1818	2019
Default Cool CFM	836	978	1121	1336	1226	1463	1647	1884
Decrease (-10%) Cool CFM	740	868	1010	1152	1063	1320	1504	1675

The effect of static pressure is included in air volumes shown.

The following control configurations are available. See Installation Instructions for details and DIP switch settings.

Heat Modes Available (Heating Blower Performance Table):

Single stage thermostat:

- 40%, 70%, 100% input (three-stage) with time delays in-between

Two-stage thermostat:

- Variable Rate Capacity Mode - furnace automatically adjusts firing rate based on first- and second-stage cycle times
- W1 demand at 70% input, W2 demand at 100% input. No delay between stages

Cool Mode Available (Cooling Blower Performance table):

First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.

Continuous Fan speeds are approximately 38% of the same second-stage COOL speed position minimum 300 cfm.

BLOWER DATA

A97USMV090C20S BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	684	835	986	1136	1287	1437	1588
Increase (+7.5%) Heat CFM	623	769	914	1059	1205	1350	1496
Default Heat CFM	562	702	842	983	1123	1263	1403
Decrease (-7.5%) Heat CFM	502	633	765	896	1028	1159	1291
Decrease (-15%) Heat CFM	441	564	687	810	932	1055	1178

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	911	1043	1227	1434	1335	1559	1719	1986
Default Cool CFM	805	960	1087	1296	1173	1433	1568	1811
Decrease (-10%) Cool CFM	700	840	991	1115	1049	1283	1451	1603

A97USMV090C20S BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR WITH OPTIONAL RETURN AIR BASE

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	686	837	987	1138	1288	1439	1589
Increase (+7.5%) Heat CFM	626	771	916	1060	1205	1349	1494
Default Heat CFM	566	705	844	983	1121	1260	1399
Decrease (-7.5%) Heat CFM	502	633	764	895	1026	1157	1288
Decrease (-15%) Heat CFM	437	560	683	806	930	1053	1176

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	913	1037	1230	1415	1329	1560	1740	1982
Default Cool CFM	827	953	1088	1278	1177	1414	1586	1807
Decrease (-10%) Cool CFM	741	855	995	1117	1044	1261	1432	1619

The effect of static pressure is included in air volumes shown.
The following control configurations are available. See Installation Instructions for details and DIP switch settings.

Heat Modes Available (Heating Blower Performance Table):

Single stage thermostat:
- 40%, 70%, 100% input (three-stage) with time delays in-between

Two-stage thermostat:
- Variable Rate Capacity Mode - furnace automatically adjusts firing rate based on first- and second-stage cycle times
- W1 demand at 70% input, W2 demand at 100% input. No delay between stages

Cool Mode Available (Cooling Blower Performance table):

First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
Continuous Fan speeds are approximately 38% of the same second-stage COOL speed position minimum 300 cfm.

BLOWER DATA

A97USMV110C20S BLOWER PERFORMANCE (less filter)

BOTTOM RETURN AIR

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	861	1049	1237	1424	1612	1800	1988
Increase (+7.5%) Heat CFM	825	1000	1174	1349	1524	1699	1874
Default Heat CFM	789	951	1112	1274	1436	1597	1759
Decrease (-7.5%) Heat CFM	731	883	1035	1187	1339	1491	1644
Decrease (-15%) Heat CFM	673	816	958	1101	1243	1386	1528

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	937	1064	1247	1407	1312	1560	1744	1955
Default Cool CFM	864	972	1146	1282	1219	1405	1569	1796
Decrease (-10%) Cool CFM	790	888	1025	1167	1075	1272	1428	1634

A97USMV110C20S BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	733	825	1009	1194	1378	1562	1747
Increase (+7.5%) Heat CFM	708	794	967	1139	1312	1484	1657
Default Heat CFM	683	763	924	1085	1245	1406	1566
Decrease (-7.5%) Heat CFM	632	707	857	1007	1157	1307	1457
Decrease (-15%) Heat CFM	580	650	790	929	1069	1209	1348

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	918	1053	1198	1366	1270	1519	1712	1899
Default Cool CFM	820	964	1095	1231	1170	1363	1555	1774
Decrease (-10%) Cool CFM	722	852	987	1116	1059	1218	1401	1581

The effect of static pressure is included in air volumes shown.
The following control configurations are available. See Installation Instructions for details and DIP switch settings.

Heat Modes Available (Heating Blower Performance Table):

Single stage thermostat:
- 40%, 70%, 100% input (three-stage) with time delays in-between

Two-stage thermostat:
- Variable Rate Capacity Mode - furnace automatically adjusts firing rate based on first- and second-stage cycle times
- W1 demand at 70% input, W2 demand at 100% input. No delay between stages

Cool Mode Available (Cooling Blower Performance table):

First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
Continuous Fan speeds are approximately 38% of the same second-stage COOL speed position minimum 300 cfm.

BLOWER DATA

A97USMV110C20S BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR WITH OPTIONAL RETURN AIR BASE

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	893	1068	1243	1419	1594	1770	1945
Increase (+7.5%) Heat CFM	814	986	1157	1329	1500	1672	1843
Default Heat CFM	736	903	1071	1238	1406	1573	1741
Decrease (-7.5%) Heat CFM	680	833	986	1139	1293	1446	1599
Decrease (-15%) Heat CFM	623	762	901	1040	1179	1318	1457

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	918	1022	1205	1371	1268	1487	1726	1913
Default Cool CFM	839	955	1084	1235	1158	1369	1568	1764
Decrease (-10%) Cool CFM	760	865	984	1109	1030	1224	1393	1575

A97USMV135D20S BLOWER PERFORMANCE (less filter)

BOTTOM RETURN AIR

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	1033	1200	1367	1534	1701	1868	2035
Increase (+7.5%) Heat CFM	957	1113	1269	1426	1582	1738	1895
Default Heat CFM	881	1026	1172	1317	1463	1608	1754
Decrease (-7.5%) Heat CFM	817	956	1095	1235	1374	1513	1652
Decrease (-15%) Heat CFM	753	886	1019	1152	1284	1417	1550

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	935	1074	1260	1450	1353	1567	1751	1994
Default Cool CFM	834	983	1116	1306	1202	1448	1616	1828
Decrease (-10%) Cool CFM	732	867	1023	1145	1080	1290	1472	1668

The effect of static pressure is included in air volumes shown.
The following control configurations are available. See Installation Instructions for details and DIP switch settings.

Heat Modes Available (Heating Blower Performance Table):

Single stage thermostat:
- 40%, 70%, 100% input (three-stage) with time delays in-between

Two-stage thermostat:
- Variable Rate Capacity Mode - furnace automatically adjusts firing rate based on first- and second-stage cycle times
- W1 demand at 70% input, W2 demand at 100% input. No delay between stages

Cool Mode Available (Cooling Blower Performance table):

First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
Continuous Fan speeds are approximately 38% of the same second-stage COOL speed position minimum 300 cfm.

BLOWER DATA

A97USMV135D20S BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	1010	1175	1340	1505	1671	1836	2001
Increase (+7.5%) Heat CFM	923	1081	1239	1398	1556	1714	1873
Default Heat CFM	836	987	1138	1290	1441	1593	1744
Decrease (-7.5%) Heat CFM	775	919	1064	1208	1352	1496	1641
Decrease (-15%) Heat CFM	715	852	989	1126	1263	1400	1537

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	938	1070	1236	1418	1337	1550	1720	1974
Default Cool CFM	837	985	1114	1296	1194	1416	1608	1781
Decrease (-10%) Cool CFM	736	870	1010	1139	1076	1282	1437	1628

A97USMV135D20S BLOWER PERFORMANCE (less filter)

SINGLE SIDE RETURN AIR WITH OPTIONAL RETURN AIR BASE

HEATING BLOWER PERFORMANCE

Heating Adjust CFM Selections	Heating Input Range and Blower Volume - CFM						
	40%	50%	60%	70%	80%	90%	100%
Increase (+15%) Heat CFM	992	1157	1322	1487	1653	1818	1983
Increase (+7.5%) Heat CFM	907	1065	1224	1382	1541	1699	1858
Default Heat CFM	822	974	1125	1277	1429	1580	1732
Decrease (-7.5%) Heat CFM	761	903	1046	1188	1330	1472	1615
Decrease (-15%) Heat CFM	700	833	966	1099	1231	1364	1497

COOLING BLOWER PERFORMANCE

Cooling Adjust CFM Selections	Blower Speed Selections							
	First Stage Cool Speed - cfm				Second Stage Cool Speed - cfm			
	Low	Medium Low	Medium High	High (Default)	Low	Medium Low	Medium High	High (Default)
Increase (+10%) Cool CFM	918	1061	1214	1382	1303	1536	1687	1975
Default Cool CFM	829	960	1091	1265	1164	1380	1584	1762
Decrease (-10%) Cool CFM	739	858	991	1116	1065	1252	1404	1604

The effect of static pressure is included in air volumes shown.
The following control configurations are available. See Installation Instructions for details and DIP switch settings.

Heat Modes Available (Heating Blower Performance Table):

Single stage thermostat:
- 40%, 70%, 100% input (three-stage) with time delays in-between

Two-stage thermostat:
- Variable Rate Capacity Mode - furnace automatically adjusts firing rate based on first- and second-stage cycle times
- W1 demand at 70% input, W2 demand at 100% input. No delay between stages

Cool Mode Available (Cooling Blower Performance table):

First stage COOL (two-stage air conditioning units only) is approximately 70% of the same second stage COOL speed position.
Continuous Fan speeds are approximately 38% of the same second-stage COOL speed position minimum 300 cfm.

COOLING OPERATING SEQUENCE
A97USMV and Single-Stage Outdoor Unit

OPERATING SEQUENCE		SYSTEM DEMAND					SYSTEM RESPONSE		
System Condition	Step	Demand			Relative Humidity		Compressor	Blower CFM (COOL)	Comments
		1st stage	O	G	Status	D*			
NO CALL FOR DEHUMIDIFICATION									
Normal Operation	1	On	On	On	Acceptable	24 VAC	High	100%	Compressor and indoor blower follow thermostat demand
BASIC MODE (only active on a Y1 thermostat demand)									
Normal Operation	1	On	On	On	Acceptable	24 VAC	High	100%	Thermostat energizes Y1 and de-energizes D on a call for de-humidification
Dehumidification Call	2	On	On	On	Demand	0 VAC	High	70%	
PRECISION MODE (operates independent of a Y1 thermostat demand)									
Normal Operation	1	On	On	On	Acceptable	24 VAC	High	100%	Dehumidification mode begins when humidity is greater than set point
Dehumidification call	2	On	On	On	Demand	0 VAC	High	70%	
Dehumidification call ONLY	1	On	On	On	Demand	0 VAC	High	70%	Thermostat will keep outdoor unit energized after cooling temperature set-point has been reached in order to maintain room humidity setpoint.
	On-board links at indoor unit with a single-stage outdoor unit: With Condensing unit - Cut W914 (R to DS) on control. With Heat Pump - Cut W914 (R to DS) & W951 (R to O)on control.								

TABLE 22

COOLING OPERATING SEQUENCE
A97USMV and Two-Stage Outdoor Unit

OPERATING SEQUENCE		SYSTEM DEMAND						SYSTEM RESPONSE		
System Condition	Step	Demand				Relative Humidity		Compressor	Blower CFM (COOL)	Comments
		1st stage	2nd stage	O	G	Status	D*			
NO CALL FOR DEHUMIDIFICATION										
Normal Operation - Y1	1	On		On	On	Acceptable	24 VAC	Low	70%	Compressor and indoor blower follow thermostat demand
Normal Operation - Y2	2	On	On	On	On	Acceptable	24 VAC	High	100%	
ROOM THERMOSTAT CALLS FOR FIRST STAGE COOLING										
BASIC MODE (only active on a Y1 thermostat demand)										
Normal Operation	1	On		On	On	Acceptable	24 VAC	Low	70%	Thermostat energizes 2nd stage and de-energizes D on a call for dehumidification
Dehumidification Call	2	On	On	On	On	Demand	0 VAC	High	70%	
PRECISION MODE (operates independent of a Y1 thermostat demand)										
Normal Operation	1	On		On	On	Acceptable	24 VAC	Low	70%	Dehumidification mode begins when humidity is greater than set point
Dehumidification call	2	On	On	On	On	Demand	0 VAC	High	70%	
Dehumidification call ONLY	1	On	On	On	On	Demand	0 VAC	High	70%	Thermostat will keep outdoor unit energized after cooling temperature setpoint has been reached in order to maintain room humidity setpoint.*
ROOM THERMOSTAT CALLS FOR FIRST AND SECOND STAGE COOLING										
BASIC MODE (only active on a Y1 thermostat demand)										
Normal Operation	1	On	On	On	On	Acceptable	24 VAC	High	100%	Thermostat energizes 2nd stage and de-energizes D on a call for dehumidification
Dehumidification Call	2	On	On	On	On	Demand	0 VAC	High	70%	
PRECISION MODE (operates independent of a Y1 thermostat demand)										
Normal Operation	1	On		On	On	Acceptable	24 VAC	Low	70%	Dehumidification mode begins when humidity is greater than set point
Dehumidification call	2	On	On	On	On	Demand	0 VAC	High	70%	
Dehumidification call ONLY	1	On	On	On	On	Demand	0 VAC	High	70%	Thermostat will keep outdoor unit energized after cooling temperature setpoint has been reached in order to maintain room humidity setpoint.
	On-board links at indoor unit with a two-stage outdoor unit: Cut factory link from Y1 to Y2 or cut W915 (Y1 to Y2) on integrated control. With Condensing unit - Cut W914 (R to DS) on integrated control; With Heat Pump - Cut W914 (R to DS) & W951 (R to O) on integrated control.									

TABLE 23

Unit Start Up

FOR YOUR SAFETY READ BEFORE OPERATING

⚠ WARNING

Do not use this furnace if any part has been underwater. A flood damaged furnace is extremely dangerous. Attempts to use the furnace can result in fire or explosion. Immediately call a qualified service technician to inspect the furnace and to replace all gas controls, control system parts, and electrical parts that have been wet or to replace the furnace, if deemed necessary.

⚠ WARNING

Danger of explosion. Can cause injury or product or property damage. Should the gas supply fail to shut off or if overheating occurs, shut off the gas valve to the furnace before shutting off the electrical supply.

⚠ CAUTION

Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch.

⚠ WARNING

During blower operation, the ECM motor emits energy that may interfere with pacemaker operation. Interference is reduced by both the sheet metal cabinet and distance.

Priming Condensate Trap

The condensate trap should be primed with water prior to startup to ensure proper condensate drainage. Either pour 10 fl. oz. (300 ml) of water into the trap, or follow these steps to prime the trap:

1. Follow the lighting instructions to place the unit into operation.
2. Set the thermostat to initiate a heating demand.
3. Allow the burners to fire for approximately 3 minutes.
4. Adjust the thermostate to deactivate the heating demand.
5. Wait for the combustion air inducer to stop. Set the thermostat to initiate a heating demand and again allow the burners to fire for approximately 3 minutes.
6. Ajust the thermostat to deactivate the heating demand and again wait for the combustion air inducer to stop. At this point, the trap should be primed with sufficient water to ensure proper condensate drain operation.

BEFORE PLACING THE UNIT INTO OPERATION

Smell all around the furnace area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

The gas valve on these units are equipped with a gas control switch. Use only your hand to move the control switch. Never use tools. If the switch will not move by hand, do not try to repair it. Force or attempted repair may result in a fire or explosion.

Placing the Furnace into Operation:

These units are equipped with an automatic ignition system. Do not attempt to manually light burners on this furnace. Each time the thermostat calls for heat, the burners will automatically light. The ignitor does not get hot when there is no call for heat on units with this ignition system.

⚠ WARNING

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or death.

Gas Valve Operation (Figure 42)

1. **STOP!** Read the safety information at the beginning of this sectioin.
2. Set the thermostat to the lowest setting.
3. Turn **OFF** all electrical power to the unit.
4. This furnace is equipped with an ignition device which automatically lights the burners. **DO NOT** try to light the burners by hand.
5. Remove the access panel.
6. Move the gas valve switch to the **OFF** position. See Figure 49.
7. Wait five minutes to clear out any gas. If you then smell gas, **STOP!** Immediately call the gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you do not smell gas go to the next step.
8. Move gas valve switch to the **ON** position. See Figure 49. **DO Not** force.

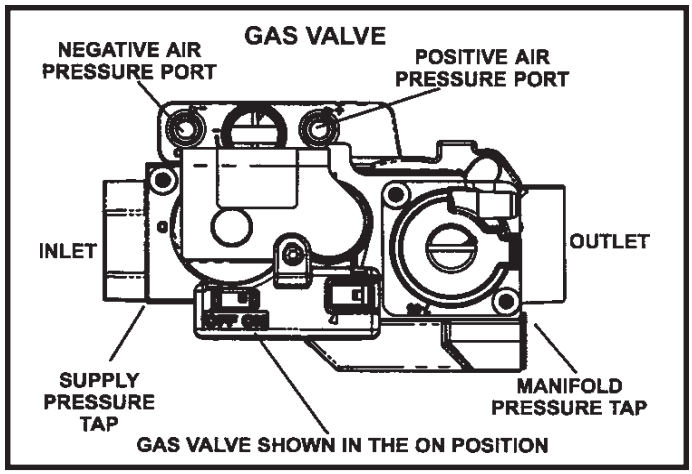


Figure 49

9. Replace the access panel.
10. Turn on all electrical power to the unit.
11. Set the thermostat to desired setting.

NOTE: *When unit is initially started, steps 1 through 11 may need to be repeated to purge air from gas line.*

12. If the Appliance will not operate, follow the instructions "Turning Off Gas to Unit" and call the gas supplier.

Turning Off Gas to Unit
1. Set the thermostat to the lowest settling.
2. Turn **OFF** all electrical power to the unit if service is to be performed.
3. Remove the access panel.
4. Move the gas valve switch to the **OFF** position.
5. Replace the access panel.

Failure To Operate
If the unit fails to operate, check the following:
1. Is the thermostat calling for heat?
2. Are access panels securely in place?
3. Is the main disconnect switch closed?
4. Is there a blown fuse?
5. Is the filter dirty or plugged? Dirty or plugged filters will cause the limit conrol to shut the unit off.
6. Is gas turned on at the meter?
7. Is the manual main shut Off valve open?
8. Is the gas valve turned on?
9. Is the unit ignition system in lock out: If the unit locks out again, inspect the unit for blockages.
10. Is blower harness connected to ignition control? Furnace will not operate unless harness is connected.

Gas Pressure Measurement

Gas Flow (Approximate)

GAS METER CLOCKING CHART				
A96UHMV UNIT	Seconds for One Revolution			
	Natural		LP	
	1 cu ft Dial	2 cu ft Dial	1 cu ft Dial	2 cu ft DIAL
-70	55	110	136	272
-90	41	82	102	204
-110	33	66	82	164
-135	27	54	68	136
Natural-1000 btu/cu ft		LP-2500 btu/cu ft		

Table 21

Furnace should operate at least 5 minutes before checking gas flow. Determine time in seconds for **two** revolutions of gas through the meter. (Two revolutions assures a more accurate time.) **Divide by two** and compare to time in Table 21. If manifold pressure matches Table 24 and rate is incorrect, check gas orifices for proper size and restriction. Remove temporary gas meter if installed.

NOTE: *A natural to LP/propane gas changeover kit is necessary to convert this unit. Refer to the changeover kit installation instruction for the conversion procedure.*

NOTE: *To obtain accurate reading, shut off all other gas appliances connected to meter.*

Supply Pressure Measurement
A threaded plug on the inlet side of the gas valve provides access to the supply pressure tap. Remove the threaded plug, install a field provided barbed fitting and connect a manometer to measure supply pressure. Replace the threaded plug after measurements have been taken.

Manifold Pressure Measurement
To correctly measure manifold pressure, the differential pressure between the positive gas manifold and the negative burner box must be considered. Use pressure test adapter kit (available as part 10L34) to assist in measurement.

1. Remove the threaded plug from the outlet side of the gas valve and install a field provided barbed fitting. Connect test gauge "+" connection to barbed fitting to measure manifold pressure.
2. Tee into the gas valve regulator vent hose and connect test gauge "-" connection.
3. Start unit on low heat (40% rate) and allow 5 minutes for unit to reach steady state.
4. While waiting for the unit to stabilize, notice the flame. Flame should be stable and should not lift from burner. Natural gas should burn blue.
5. After allowing unit to stabilize for 5 minutes, record manifold pressure and compare to value given in Table 24.
6. Repeat steps 3, 4 and 5 on HIGH HEAT.

NOTE: *Shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to remove barbed fitting and replace threaded plug.*

⚠ CAUTION

DO NOT attempt to make adjustments to the gas valve.

Operating Pressure Signal
Operating pressure signal can be taken while the manifold pressure pressure check is taken (using two measuring devices). Or, taken after the manifold pressure measurem - ent is complete.

1 - Tee into the negative line between the gas valve and pressure switch and connect to measuring device negative "-".
2 - Tee into the positive line between the gas valve and pressure switch and connect to measuring device positive "+"..
3 -Start unit on low heat (40% rate) and allow 5 minutes for unit to reach steady state.
4 -After allowing unit to stabilize for 5 minutes, record operating pressure signal and compare to value given in table 25.
5 - Repeat steps 3 on 4 high heat.

Table 25

Manifold and Operating Signal Pressures in inches 0 - 7500 ft (0 - 2286 m)

Firing Rate	Manifold Pressure Nat Gas			Manifold Pressure LP/Propane			Operating Pressure Signal (Delta P)		
	Min	**Normal**	Max	Min	**Normal**	Max	Min	**Normal**	Max
40 %	0.5	0.6	0.7	1.3	1.6	1.9	0.25	0.30	0.35
70%	1.7	1.9	2.1	5.1	5.5	5.9	0.60	0.65	0.70
100%	3.2	3.5	3.8	9.5	10.0	10.5	1.10	1.15	1.20

NOTE - A natural to LP/propane gas changeover kit (table 24) is necessary to convert this unit. Refer to the changeover kit installation instructions for the conversion procedure.

High Altitude Information

NOTE: *In Canada,certification for installationa at elevations over 4500 feet (1372 m) is the jurisidiction of local authorities.*

These units require no manifold pressure adjustments for operation at altitudes up to 7,500 feet (2286 m) above sea level. Table 24 lists conversion kit requirements, pressure switch requirements and manifold pressures at all altitudes.

The combustion air pressure switch is factory set and requires no adjustment.

Table 24

Conversion Kit Requirements

Model Input Size	LP/Propane Kit	High Altitude Pressure Switch Kit	
	0 - 10,000 (0 - 3048 m)	0 - 7,500 (0 - 2286 m)	7,501 - 10,000 (2287 - 3048m)
070	68W77	Not required	80W69
090			
110			
135			

Proper Combustion

Furnace should operate a minimum of 15 minutes with correct manifold pressure and gas flow rate before checking combustion. Take combustion sample beyond the flue outlet and compare to the tables below. The maximum carbon monoxide reading should not exceed 50 ppm.

High Fire

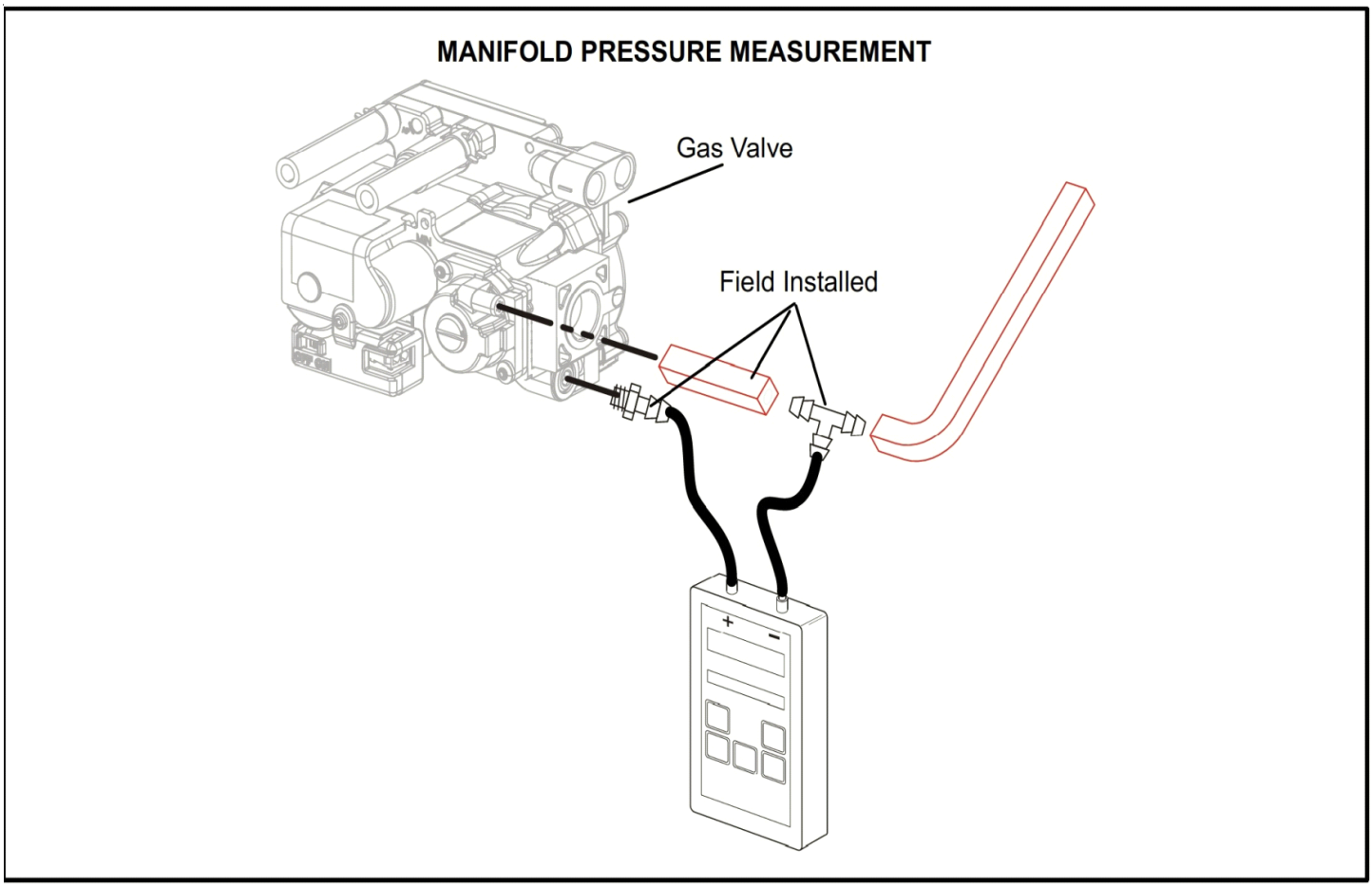
A96UHMV UNIT	CO_2% For Nat	CO_2% For L.P.
070B12	7.6 - 8.6	9.1 - 10.1
090C12		
090C16		
090C20		
110C20		
135D20		

Table 22

Low Fire

Model Input Size	CO_2% For Nat	CO_2% For L.P.
070	5.7	7.2 - 8.2
090	5.3 - 6.3	6.8 - 7.8
110		
135		

Table 23


MANIFOLD PRESSURE MEASUREMENT
Gas Valve
Field Installed

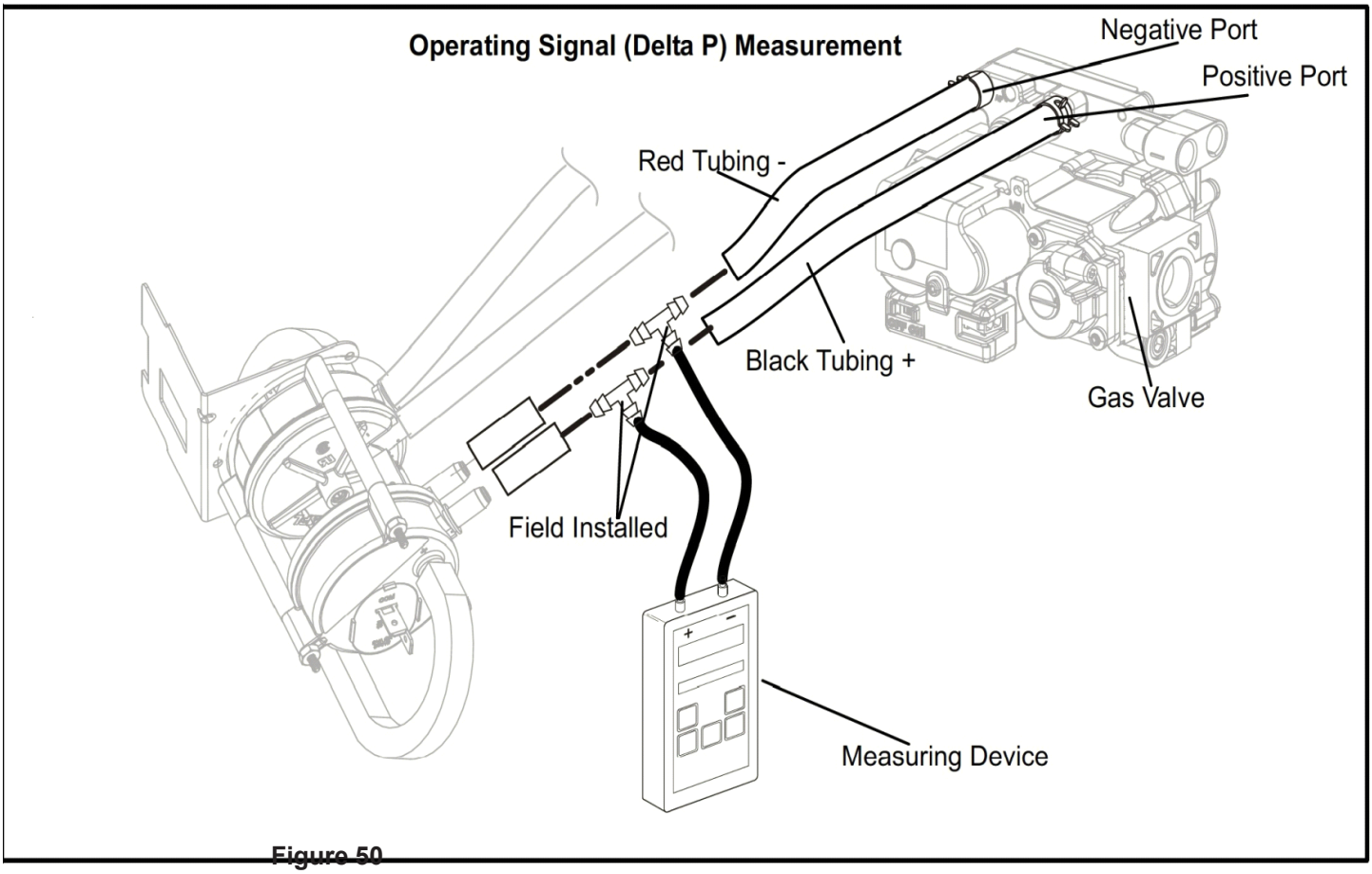

Operating Signal (Delta P) Measurement
Negative Port
Positive Port
Red Tubing -
Black Tubing +
Gas Valve
Field Installed
Measuring Device

Figure 50

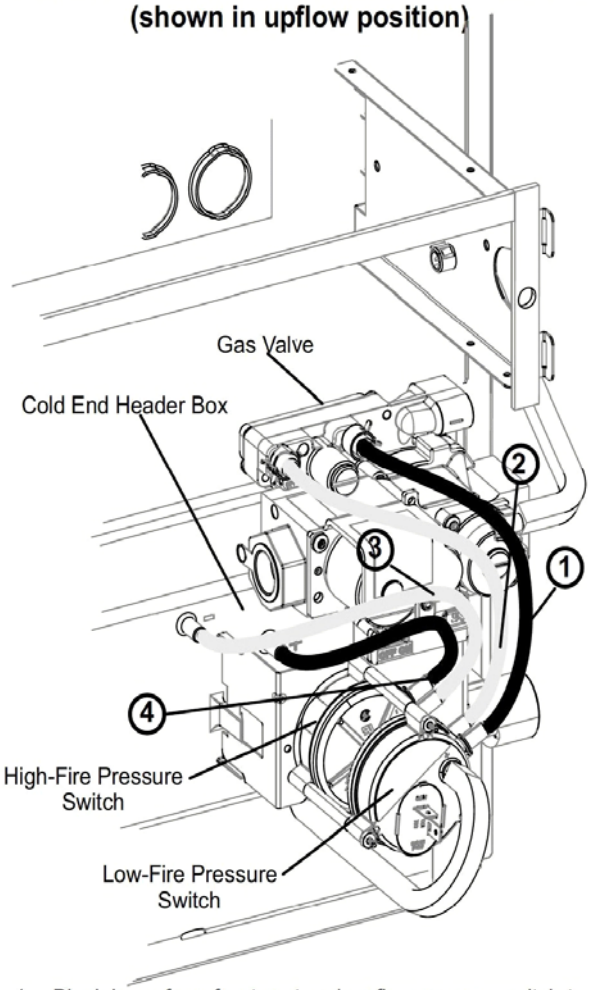
Other Unit Adjustments

Primary Limit
The primary limit is located on the heating compartment vestibule panel. This limit is factory set and requires no adjustment.

Flame Rollout Switches (Two)
These manually reset switches are located on the inside of the burner box. If tripped, check for adequate combustion air before resetting.

Pressure Switches (Two)
The pressure switches are located on the cold end header box. These switches check for proper combustion air inducer operation before allowing ignition trial. The switches are factory set and require no adjustment. Pressure switch tubing installation is critical for safe operation. See figure below.

PRESSURE SWITCH TUBING INSTALLATION (shown in upflow position)



1 - Black hose from front port on low-fire pressure switch to positive port on the gas valve.
2 - Red hose from rear port on low-fire pressure switch to the negative port on the gas valve.
3 - Red hose from front port on high-fire pressure switch to negative port on cold end header box.
4 - Black hose from rear port on high-fire pressure switch to positive port on cold end header box.

Temperature Rise
After the furnace has been started and supply and return air temperatures have been allowed to stabilize, check the temperature rise with the unit operating at 100 percent firing rate. If necessary, adjust the blower speed to maintain the temperture rise within the range shown on the unit nameplate. Increase the blower speed to decrease the temperature. Decrease the blower speed to increase the temperature. Failure to adjust the temperature rise may cause erratic limit operation.

Thermostat Heat Anticipation
Set the heat anticipator setting (if adjustable) according to the amp draw listed on the wiring diagram that is attached to the unit.

Electronic Ignition
The integrated control has a feature that serves as an automatic reset device for ignition control lockout caused by ignition failure. This type of lockout is usually due to low gas line pressure. After one hour of continuous thermostat demand for heat, the control will break and remake thermostat demand to the furnace and automatically reset the control to begin the ignition sequence.

Exhaust and Air Intake Pipe
1. Check exhaust and air intake connections for tightness and to make sure there is not blockage.
2. Are pressure switches closed? Obstructed exhaust pipe will cause unit to shut off at pressure switches. Check termination for blockages.
3. Reset manual flame rollout switches on burner box cover.

Heating Sequence of Operation
The integrated control initiates a pressure switch calibration at the initial unit start-up on a call for heat. The ignition control will also initiate a calibration any time main power is turned off and back on and a heating demand is present. Additional calibrations may be initiated by the service technician during field test sequence. The following heating sequence of operation assumes completion of a successful calibration.

NOTE: In Comfort Sync™ communicating applications, the sequence of operation is the same but all DIP switch settings are overidden by the thermostat.

NOTE: *The thermostat selection DIP switch on the integrated control is factory set in the "TWO STAGE" position.*

Applications Using a Two Stage Thermostat

A-Heating Sequence - Control Thermostat Selection DIP switch in "Two Stage" Position (Factory Settling)
1. On a call for heat, thermostat first stage contacts close sending a signal to the integrated control. The integrated control runs a self diagnostic program and checks high temperature limit switches for normally closed contacts and pressure switches for normally open contacts. The combustion air inducer is energized at ignition speed, Which is approximately the same as the inducer speed at 70 percent firing rate.
2. Once the control receives a signal that the low fire pressure switch has closed, the combustion air inducer begins a 15 second prepurge in the ignition speed.
3. After the prepurge is complete, a 20 second initial ignitor warm up period begins. The combustion air inducer continues to operate at the ignition speed.
4. After the 20 second warm up period has ended, the gas valve is energized and ignition occurs. At the same time, the control module sends a signal to begin an indoor blower 30 second ON delay. When the delay ends, the indoor blower motor is energized at a speed that matches the firing rate. After the 10 second ignition stabilization delay expires, the inducer speed is adjusted to the appropriate target rate. The inducer will remain at the 70 percent speed as long as the thermostat has a first stage heating demand.
5. If second stage heat is required, the thermostat second stage heat contacts close and send a signal to the integrated control. The integrated control initiates a 30 second stage recognition delay.
6. At the end of the recognition delay and on all subsequent calls for heat in the same heating cycle, the intergrated control energizes the combustion air inducer at high speed. The control also checks the high fire pressure switch to make sure it is closed. As the inducer speed is increased to high, the indoor blower motor is adjusted to a speed which is appropriate for the target rate.
7. When the demand for high fire (second stage) heat is satisfied, the gas valve is de-energized and the field selected indoor blower off delay begins. The combustion air inducer begins a 20 second post purge period.
8. When the combustion air post purge period is complete, the inducer is de-energized. The indoor blower is de-energized at the end of the off delay.

Application Using a Two Stage Thermostat

B - Heating Sequence - Control Thermostat Selection DIP switch in "Variable Capacity" Position
1. On a call for heat, thermostat first stage contacts close sending a signal to the integrated control. The integrated control runs a self diagnostic program and checks high temperature limit switches for normally closed contacts and pressure switches for normally open contacts. The combustion air inducer is energized at ignition speed, which is approximately the same as the inducer speed at 70 percent firing rate.
2. Once the control receives a signal that the low fire pressure switch has closed, the combustion air inducer begins a 15 second prepurge in low speed.
3. After the prepurge is complete, a 20 second initial ignitor warm-up period begins. The combustion air inducer continues to opeate at the ignition speed.
4. After the 20 second warm up period has ended, the gas valve is energized and ignition occurs. At the same time, the control module begins an indoor blower 30 second ON delay. When the delay ends, the indoor blower motor is energized at a speed that matches the firing rate. After the 10 second ignition stabilization delay expires, the inducer speed is adjusted to the appropriate target rate. If the furnace is operating in the initial heating cycle after power up, the initial firing rate will be approximately 40 percent. The firing rate on subsequent cycles will be automatically adjusted by the integrated control based on thermostat cycles. The firing rate will vary and will range from 40 percent to 90 percent. The furnace will continue this operation as long as the thermostat has a first stage heating demand.

5. If second-stage heat is required, the thermostat second stage heat contacts close and send a signal to the integrated control. The integrated control either increases the firing rate to 70 percent (if the current rate is at or below 60 percent) or increases the firing rate by 10 percent (if the current rate is above 60 percent). If the call for heat continues 5 minutes beyond this initial upstage, the rate will be increased by 10 percent every 5 minutes until the call for heat is satisfied or the furnace reaches 100 percent rate. As the firing rate increases, the indoor blower motor is adjusted to a speed which is appropriate for the target rate.
6. If second-stage heat demand is satisfied, but first stage is still present, the furnace will continue to operate at the present firing rate until the heat cycle ends.
7. When the demand for first and second stage heat is satisfied, the gas valve is de-energized and the fieldselected indoor blower off delay begins. The combustion air inducer begins a 20 second post-purge period.
8. When the combustion air post purge period is complete, the inducer is de-energized. The indoor blower is de-energized at the end of the off delay.

Applications Using A Single-Stage Thermostat

C - Heating Sequence -- Control Thermostat Selection DIP switch in "Single Stage" Position

1. On a call for heat, thermostat first stage contacts close sending a signal to the integrated control. The integrated control runs a self-diagnostic program and checks high temperature limit switches for normally closed contacts and pressure switches for normally open contacts. The combustion air inducer is energized at the ignition speed, which is approximately the same as the inducer speed at 70 percent firing rate.
2. Once the control receives a signal that the low fire pressure switch has closed, the combustion air inducer begins a 15 second prepurge at the ignition speed.
3. After the prepurge is complete, a 20 second initial ignitor warm up period begins. The combustion air inducer continues to operate at the ignition speed.
4. After the 20 second warm up period has ended, the gas valve is energized and ignition occurs, which initiates a 10 second ignition stabilization delay. At the same time, the control module sends a signal to begin an indoor blower 30 second **ON** delay. When the delay ends, the indoor blower motor is energized at a speed which is appropriate for the firing rate. After the 10 second ignition stabilization delay expires, the inducer speed is adjusted to 40 percent speed. The integrated control also initiates a second-stage on delay (factory set at 7 minutes; adjustable to 12 minutes).
5. If the heating demand continues beyond the secondstage on delay, the integrated control energizes the combustion air inducer at 70 percent speed. The indoor blower motor is adjusted to a speed which matches the target rate. A fixed, 10 minute third stage on delay is initiated.
6. If the heating demand continues beyond the thirdstage on delay, the integrated control energizes the inducer at high speed. The indoor blower motor is adjusted to a speed which is appropriate for the target rate.
7. When the thermostat heating demand is satisfied, the gas valve is de-energized and the combustion air inducer begins a 20 second post purge. The field selected indoor blower off delay begins.
8. When the combustion air post purge period is complete, the inducer is de-energized. The indoor blower is de-energized at the end of the off delay.

Service

⚠ WARNING

ELECTRICAL SHOCK, FIRE, OR EXPLOSION HAZARD.

Failure to follow safety warnings exactly could result in dangerous operation, serious injury, death or property damage.

Improper servicing could result in dangerous operation, serious injury, death, or property damage.

Before servicing, disconnect all electrical power to furnace.

When servicing controls, label all wires prior to disconnecting. Take care to reconnect wires correctly. Verify proper operation after servicing.

At the beginning of each heating season, system should be checked as follows by a qualified service technician:

Blower
Check the blower wheel for debris and clean if necessary. The blower motors are prelubricated for extended bearing life. No further lubrication is needed.

⚠ WARNING

The blower access panel must be securely in place when the blower and burners are operating. Gas fumes, which could contain carbon monoxide, can be drawn into living space resulting in personal injury or death.

Filters
All filters are installed external to the unit. Filters should be inspected monthly. Clean or replace the filters when necessary to ensure proper furnace operation. Table 1 lists recommended filter sizes.

Exhaust and air intake pipes
Check the exhaust and air intake pipes and all connections for tightness and to make sure there is no blockage.

NOTE: *After any heavy snow, ice or frozen fog event the furnace vent pipes may become restricted. Always check the vent system and remove any snow or ice that may be obstructing the plastic intake or exhaust pipes.*

Electrical
1. Check all wiring for loose connections.
2. Check for the correct voltage at the furnace (furnace operating).Correct voltage is 120VAC +/- 10%.
3. Check amp-draw on the blower motor with the blower access panel in place.
   Motor Nameplate_____Actual_____

Winterizing and Condensate Trap Care
1. Turn off power to the unit.
2. Have a shallow pan ready to empty condensate water.
3. Remove the drain cap from the condensate trap and empty water. Inspect the trap then reinstall the drain cap.

Cleaning Heat Exchanger
If cleaning the heat exchanger becomes necessary, follow the below procedures and refer to Figure 1 when disassembling unit. Use papers or protective covering in front of furnace while removing heat exchanger assembly.
1. Turn off electrical and gas supplies to the furnace.
2. Remove the furnace access panels.
3. Disconnect the 2 pin plug from the gas valve.
4. Remove gas supply line connected to gas valve. Remove the burner box cover and remove gas valve manifold assembly.
5. Remove sensor wire from sensor. Disconnect 2 pin plug from the ignitor.
6. Disconnect wires from flame rollout switches.
7. Remove four burner box screws at the vestibule panel and remove burner box. Set burner box assembly aside.

NOTE: *If necessary, clean burners at this time. Follow procedures outlined in Burner Cleaning section.*

8. Loosen the clamps to the flexible exhaust coupling.
9. Disconnect condensate drain line from the cold end header box.
10. Disconnect condensate drain tubing from flue collar. Remove screws that secures the flue collar into place. Remove flue collar. It may be necessary to cut the exiting exhaust pipe for removal of the fitting.
11. Mark and disconnect all combustion air pressure tubing from cold end header collector box.
12. Mark and remove wires from pressure switches. Remove pressure switches. Keep tubing attached to pressure switches.
13. Disconnect the 4 pin plug from the combustion air inducer. Remove two screws which secure combustion air inducer to collector box. Remove combustion air inducer assembly. Remove ground wire from vest panel.
14. Remove electrical junction box from the side of the furnace.
15. Mark and disconnect any remaining wiring to heating compartment components. Disengage strain relief bushing and pull wiring and bushing through the hole in the blower deck.
16. Remove the primary limit from the vestibule panel.
17. Remove two screws from the front cabinet flange at the blower deck. Spread cabinet sides slightly to allow clearance for removal of heat exchanger.

18. Remove screws along vestibule sides and bottom which secure vestibule panel and heat exchanger assembly to cabinet. Remove two screws from blower rail which secure bottom heat exchanger flange. Remove heat exchanger from furnace cabinet.
19. Back wash heat exchanger with soapy water solution or steam. If steam is used it must be below 275°F (135°C).
20. Thoroughly rinse and drain the heat exchanger. Soap solutions can be corrosive. Take care to rinse entire assembly.
21. Reinstall heat exchanger into cabinet making sure that the clamshells of the heat exchanger assembly are resting on the support located at the rear of the cabinet. Remove the indoor blower to view this area through the blower opening.
22. Re-secure the supporting screws along the vestibule sides and bottom to the cabinet.
23. Reinstall cabinet screws on front flange at blower deck.
24. Reinstall the primary limit on the vestibule panel.
25. Route heating component wiring through hole in blower deck and reinsert strain relief bushing.
26. Reinstall electrical junction box.
27. Reinstall the combustion air inducer. Reconnect the 4 pin plug to the wire harness.
28. Reinstall pressure switches and reconnect pressure switch wiring.
29. Carefully connect combustion air pressure switch hosing from pressure switches to proper stubs on cold end header collector box.
30. Reconnect condensate drain line to the cold end header box.
31. Use securing screws to reinstall flue collar to the top cap on the furnace. Reconnect exhaust piping and exhaust drain tubing.
32. Replace flexible exhaust adapter on combustion air inducer and flue collar. Secure using two existing hose clamps.
33. Reinstall burner box assembly in vestibule area.
34. Reconnect flame roll-out switch wires.
35. Reconnect sensor wire and reconnect 2 pin plug from ignitor.
36. Secure burner box assembly to vestibule panel using four existing screws. Make sure burners line up in center of burner ports.
37. Reinstall gas valve manifold assembly. Reconnect gas supply line to gas valve.
38. Reinstall burner box cover.
39. Reconnect 2 pin plug to gas valve.
40. Replace the blower compartment access panel.
41. Refer to instruction on verifying gas and electrical connections when re-establishing supplies.
42. Follow lighting instructions to light and operate furnace for 5 minutes to ensure that heat exchanger is clean and dry and that furnace is operating properly.
43. Replace heating compartment access panel.

Cleaning the Burner Assembly

1. Turn off electrical and gas power supplies to furnace. Remove upper and lower furnace access panels.
2. Disconnect the 2 pin plug from the gas valve.
3. Remove the burner box cover.
4. Disconnect the gas supply line from the gas valve. Remove gas valve/manifold assembly.
5. Mark and disconnect sensor wire from the sensor. Disconnect wires from flame rollout switches.
6. Remove four screws which secure burner box assembly to vest panel. Remove burner box from the unit.
7. Use the soft brush attachment on a vacuum cleaner to gently clean the face of the burners. Visually inspect the inside of the burners and crossovers for any blockage caused by foreign matter. Remove any blockage.
8. Reinstall the burner box assembly using the existing four screws. Make sure that the burners line up in the center of the burner ports.
9. Reconnect the sensor wire and reconnect the 2 pin plug to the ignitor wiring harness. Reconnect wires to flame rollout switches.
10. Reinstall the gas valve manifold assembly. Reconnect the gas supply line to the gas valve. Reinstall the burner box cover.
11. Reconnect 2 pin plug to gas valve.
12. Replace the blower compartment access panel.
13. Refer to instruction on verifying gas and electrical connections when re-establishing supplies.
14. Follow lighting instructions to light and operate furnace for 5 minutes to ensure that heat exchanger is clean and dry and that furnace is operating properly.
15. Replace heating compartment access panel.

Planned Service

A service technician should check the following items during an annual inspection. Power to the unit must be shut off for the service technician's safety.

Burners - Must be inspected for rust, dirt, or signs of water.

Vent pipe - Must be inspected for signs of water, cracked, damaged or sagging pipe, or disconnected joints.

Unit appearance - Must be inspected for rust, dirt, signs of water, burnt or damaged wires, or components.

Blower access door - Must be properly in place and provide a seal between the return air and the room where the furnace is installed.

Return air duct - Must be properly attached and provide an air seal to the unit.

Operating performance - Unit must be observed during operation to monitor proper performance of the unit and the vent system.

Combustion gases - Flue products must be analyzed and compared to the unit specifications.

Problems detected during the inspection may make it necessary to temporarily shut down the furnace until the items can be repaired or replaced.

Instruct the homeowners to pay attention to their furnace. Situations can arise between annual furnace inspections that may result in unsafe operation.

Integrated Control Diagnostic Codes

Press the diagnostic push button and hold it to cycle through a menu of options. Every five seconds a new menu item will be displayed.
Release the button when the desired mode is displayed.
When a solid "P" is displayed, the furnace capacity/ size can be programmed.
When the solid "E" is displayed, the control enters the Error Code Recall mode. Error Code Recall mode menu options: No change (displaying error history) remains in Error Code Recall mode; solid "=" exits Error Code Recall mode; and solid "c" clears the error history. Must press button while flashing "c" is displayed to clear error codes.
When the solid "-" is displayed, the control enters the Field Test mode. Field Test mode menu options: Solid "C" starts pressure switch calibration; blinking "-" exits Field Test mode.

Code	Diagnostic Codes/Status of Equipment	Action Required to Clear and Recover
.	Idle mode (Decimal blinks at 1 Hertz -- 0.5 second ON, 0.5 second OFF).	
A	Cubic feet per minute (cfm) setting for indoor blower (1 second ON, 0.5 second OFF) / cfm setting for current mode displayed.	
C	Cooling stage (1 second ON, 0.5 second OFF) / 1 or 2 displayed / Pause / cfm setting displayed / Pause / Repeat codes).	
d	Dehumidification mode (1 second ON) / 1 second OFF) / cfm setting displayed / Pause / Repeat Codes).	
h	Variable Capacity Heat (1 second ON, 0.5 second OFF) / % of input rate displayed / Pause/ cfm setting / Pause/ Repeat codes.	
H	Heat Stage (1 second ON, 0.5 second OFF) / 1 or 2 displayed / Pause / cfm setting displayed / Pause / Repeat codes.	
df	Defrost mode.	
E 105	Device communication problem - No other devices on BUS (Communication system).	Equipment is unable to communicate. Check for mis wire and loose connections and check for a high voltage source of noise close to the system. (welder etc.).
E 110	Low line voltage.	Line Voltage low (Voltage lower than nameplate rating) Check voltage.
E 113	High line voltage.	Line Voltage High (Voltage higher than nameplate rating) Check voltage.
E 114	Line voltage frequency out-of-range.	No 60 hertz power (Check voltage and frequency).
E 115	Low 24V - Control will restart if the error recovers.	24 voltage low (Range is 18 to 30 volts) Check voltage.
E 120	Unresponsive device.	Usually caused by delay in outdoor unit responding to indoor unit poling recycle power, check wiring.
E 124	Active communicating thermostat signal missing for more than 3 minutes.	Equipment lost communication with the thermostat. Check connections and cycle power on the thermostat.
E 125	Control failed self-check, internal error, failed hardware. Will restart if error recovers. Integrated furnace control not communicating. Covers hardware errors (flame sense circuit faults, pin shorts, etc.).	Hardware problem on the control board. Cycle power on control. Replace if problem prevents service and is persistent.
E 126	Failed internal control communication between microcontrollers.	Hardware problem on the control board. Cycle power on control. Replace if problem prevents service and is persis-tent.
E 131	Corrupted control parameters (Verify configuration of system).	Reconfigure the system. Replace board if service (heating /cooling) is unavailable.
E 180	Outdoor air sensor failure - NO error if disconnected. Only shown if shorted or out-of-range.	Compare outdoor sensor resistance to temperature resistance charts in installation instructions. Replace if necessary.
E 200	Hard lockout - Rollout circuit open or previously open.	Correct unit cause of rollout trip or replace flame rollout switch and test furnace operation.
E 201	Indoor blower communication failure - Unable to communicate with blower motor.	Indoor blower communication failure including power outage.
E 202	Indoor blower motor mis-match - Indoor motor horsepower does not match unit capacity.	Incorrect furnace size code selected. Check unit size codes on configuration guide or in installation instructions.
E 203	Appliance capacity / size is NOT programmed. Invalid unit codes refer to configuration flow chart in installation instructions.	No furnace size code selected. Check unit size codes on configuration guide or in installation instructions.
E 204	Gas valve mis-wired.	Check operation of gas valve.
E 205	Gas valve control relay contact shorted.	Check operation of gas valve.
E 207	Hot surface ignitor sensed open - Refer to troubleshooting in installation instruction.	Measure resistance of Hot Surface Ignitor, replace if open or not within specification.

Integrated Control Diagnostic Codes (continued)

Code	Diagnostic Codes/Status of Equipment	Action Required to Clear and Recover
E 223	Low pressure switch failed open - Refer to troubleshooting in installation instruction.	Check inches of water column pressure during operation of low pressure switch on heat call, measure inches of water column of operating pressure, inspect vent and combustion air inducer for correct operation and restriction.
E 224	Low pressure switch failed closed - Refer to troubleshooting in installation instruction.	Check low pressure switch for closed contacts, measure inches of water column of operating pressure, inspect vent and combustion air inducer for correct operation and restriction.
E 225	High pressure switch failed open - Refer to troubleshooting in installation instruction.	Check inches of water column pressure of high pressure switch on heat call, measure inches of water column of operating pressure, inspect vent and combustion air inducer for correct operation and restriction.
E 226	High pressure switch failed closed - Refer to troubleshooting in installation instruction.	Check high pressure switch for closed contacts, measure inches of water column of operating pressure, inspect vent and combustion air inducer for correct operation and restriction.
E 227	Low pressure switch open during trial for ignition or run mode. Refer to troubleshooting in installation instruction.	Check inches of water column pressure during operation of low pressure switch on heat call, measure inches of water column of operating pressure, inspect vent and combustion air inducer for correct operation and restriction.
E 228	Unable to perform successful pressure switch calibration.	Retry after 300 seconds. Error counter cleared when exiting lockout, unable to perform pressure switch calibration. Check vent system and pressure switch wiring connections.
E 240	Low flame current - Run mode - Refer to troubleshooting in installation instruction.	Check micro amperes of flame sensor, clean or replace sensor. Measure voltage of neutral to ground for good unit ground.
E 241	Flame sensed out of sequence - Flame still present.	Shut off gas, check for gas valve leak.
E 250	Limit switch circuit open - Refer to troubleshooting in installation instruction.	Check why limit is tripping, overfired, low air flow.
E 252	Discharge air temperature too high (gas heat only).	Check temperature rise, air flow and input rate.
E 270	Soft lockout - Exceeded maximum number of retries. No flame current sensed.	Check for gas flow, ignitor lighting burner, flame sensor current.
E 271	Soft lockout - Exceeded maximum number of retries. Last retry failed due to the pressure switch opening.	See E 223.
E 272	Soft lockout - Exceeded maximum number of recycles. Last recycle due to the pressure switch opening.	See E 223 and E 225.
E 273	Soft lockout - Exceeded maximum number of recycles. Last recycle due to flame failure.	See E 240.
E 274	Soft lockout - Exceeded maximum number of recycles. Last recycle failed due to the limit circuit opening or limit remained open longer than 3 minutes.	See E 250.
E 275	Soft lockout - Flame sensed out of sequence from code 241 fault. Flame signal is gone.	See E 241.
E 276	Soft lockout - Exceeded maximum number of calibration retries.	See E 228.
E 290	Ignitor circuit fault - Failed ignitor or triggering circuitry.	See E 207.
E 291	Restricted air flow - Cubic feet per minute is lower than what is needed for minimum firing rate.	Check for dirty filter, unit air flow restriction, blower performance.
E 292	Indoor blower motor unable to start - Seized bearings, stuck wheel, etc.	Indoor blower motor unable to start (seized bearing, stuck wheel, etc), replace motor or wheel if assembly does not operate or meet performance.
E 294	Combustion air inducer motor amp draw is too high.	Check combustion blower bearings, wiring , amperes, replace if it does not operate or meet performance.

Integrated Control Diagnostic Codes (continued)

Code	Diagnostic Codes/Status of Equipment	Action Required to Clear and Recover
E 295	Indoor blower motor temperature is too high.	Indoor blower motor over temperature (motor tripped on internal protector), Check motor bearings, amperes. Replace if necessary.
E 310	Discharge error sensor failure - No error if disconnected. Only shown if shorted or out-of-range.	Discharge air temperature(DATS) out of range, code is activated during ”Field test mode”.
E 311	Heat rate reduced to match indoor blower air flow. Replace filter or repair duct restriction.	Furnace blower in cutback mode due to restricted airflow. Check filter and ductwork. To clear replace filter if needed or repair/ add ductwork.
E 312	Restricted air flow in cooling or continuous fan mode is lower than cfm setting.	Restricted airflow - Indoor blower is running at a reduced cubic feet per minute (Cutback Mode) - The variable speed motor has pre-set speed and torque limiters to protect the motor from damage caused by operating out of its designed parameters (0 to 0.8 inches water column total external static pressure). Check filter and ductwork. To clear replace filter if needed or repair/ add ductwork.
E 313	Indoor or outdoor unit capacity mismatch.	Incorrect Indoor /outdoor capacity code selected. Check for proper configuration in installation instructions. Alarm is just a warning. The system operation is not impacted at all and alarm would clear when Commissioning is exited.
E 331	Global network connection - Communication link problem.	For Future Use.
E 347	No 24 Volt output on Y1 to C with non-communicating outdoor unit.	Y1 relay / Stage 1 failed (Pilot relay contacts did not close or the relay coil did not energize).
E 348	No 24 Volt output on Y2 to C with non-communicating outdoor unit.	Y2 relay / Stage 2 failed (Pilot relay contacts did not close or the relay coil did not energize).
E 349	No 24 Volts between R & O with non-communicating outdoor unit (Dual fuel module required for heat pump application).	Configuration link R to O needs to be cut on control board.

Configuring Unit Size Codes

Power-Up - Number displayed by integrated represents control unit size code (furnace model and capacity). If three horizontal bars are displayed followed by continuous E203, furnace control does not recognize **unit size code**. Configure per the following:

Furnace control in **IDLE** mode (No heating, cooling or indoor fan operation)

Yes

No

Turn room thermostat to **OFF**

To enter **Field Test Mode:** push and hold button next to 7-segment LED display until **solid dash** symbol appears. Release button.

If alarm is present, furnace control will display error code. If alarm is not present solid **dash** starts blinking on 7-segment LED display.

Push and hold button until the solid **P** symbol is displayed on the 7-segment LED. Release button. This mode allows the user to select a unit size code number that matches the furnace model size and capacity.

***IMPORTANT**: Field replacement controls may need to be manually configured to validate furnace unit size code.*

Solid **P** starts blinking on 7-Segment LED

Push and hold button. Integrated control will display unit size code number for each furnace model for five seconds.

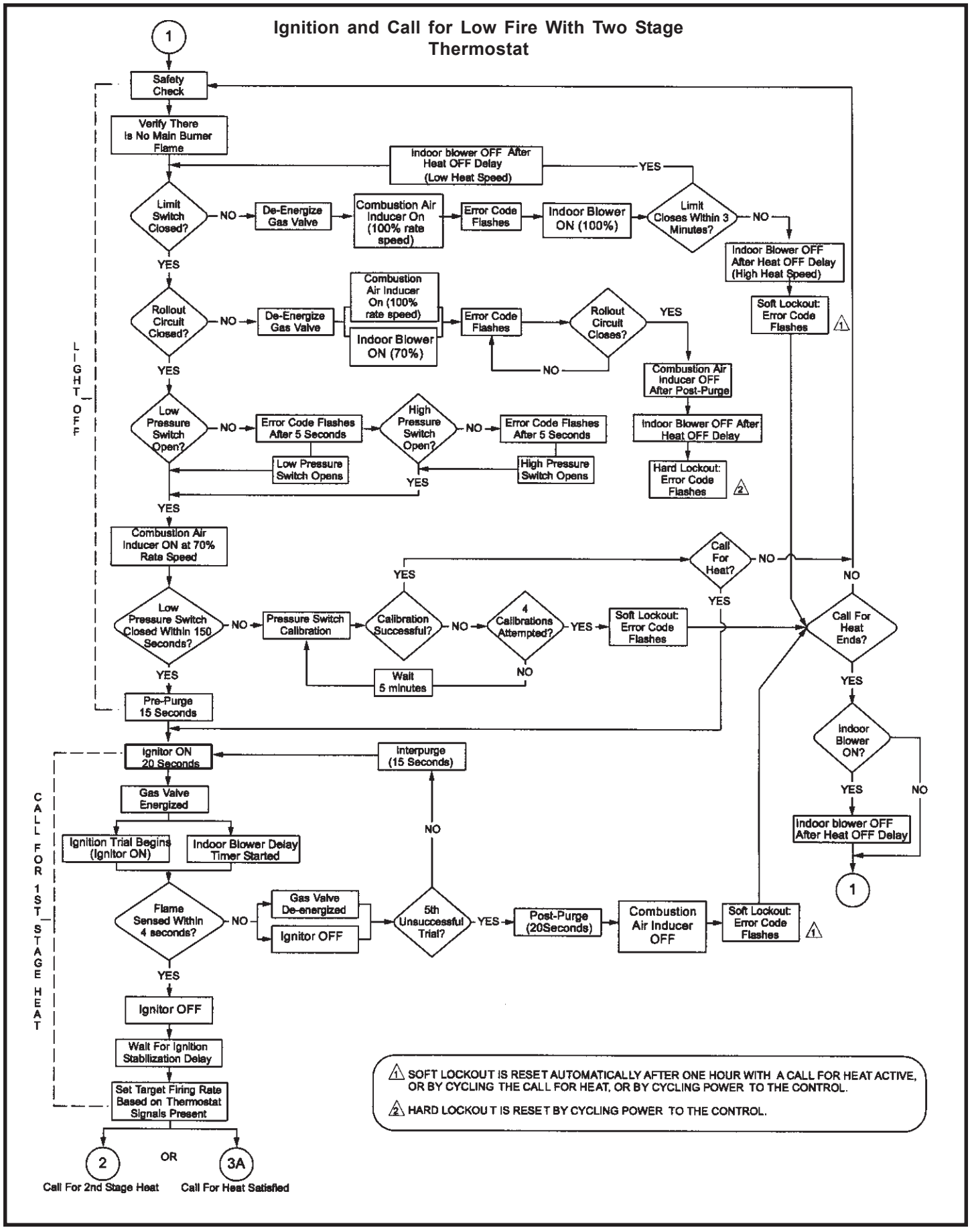
UNIT SIZE CODE	FURNACE MODEL
1	A97USMV070B12
2	A97USMV090C12
3	A97USMV090C16
4	A97USMV090C20
5	A97USMV110C20
6	A97USMV135D20

When the correct unit size code is displayed, release button. Selected code will flash for 10-second period. During that period, hold push button until code stops blinking (disappears for 2 seconds). Integrated control will store code in memory and will automatically exit **Field Test Mode** and reset. (If 10 second period expires or push button is held less than five seconds, control will automatically exit **Field Test Mode** and go into **IDLE** mode without storing unit size code. If this happens, programming function must be repeated).

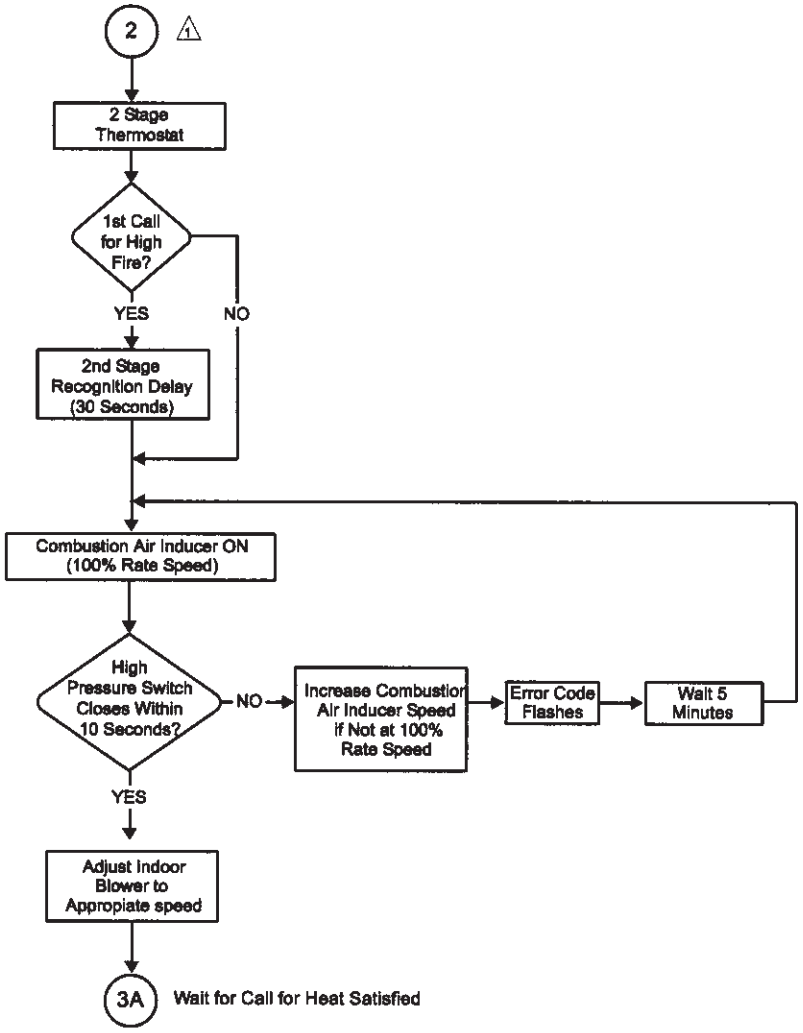
Verify that the selected unit size code is correct and stored in non-volatile memory by cycling the 24 volt power to the furnace control. (At 24 volt power-up of the furnace control, the 7-segment LED will display a unit size code. If three horizontal bars display, board does not recognize unit size code. Programming function must be repeated)

FINISHED

Ignition and Call for Low Fire With Two Stage Thermostat



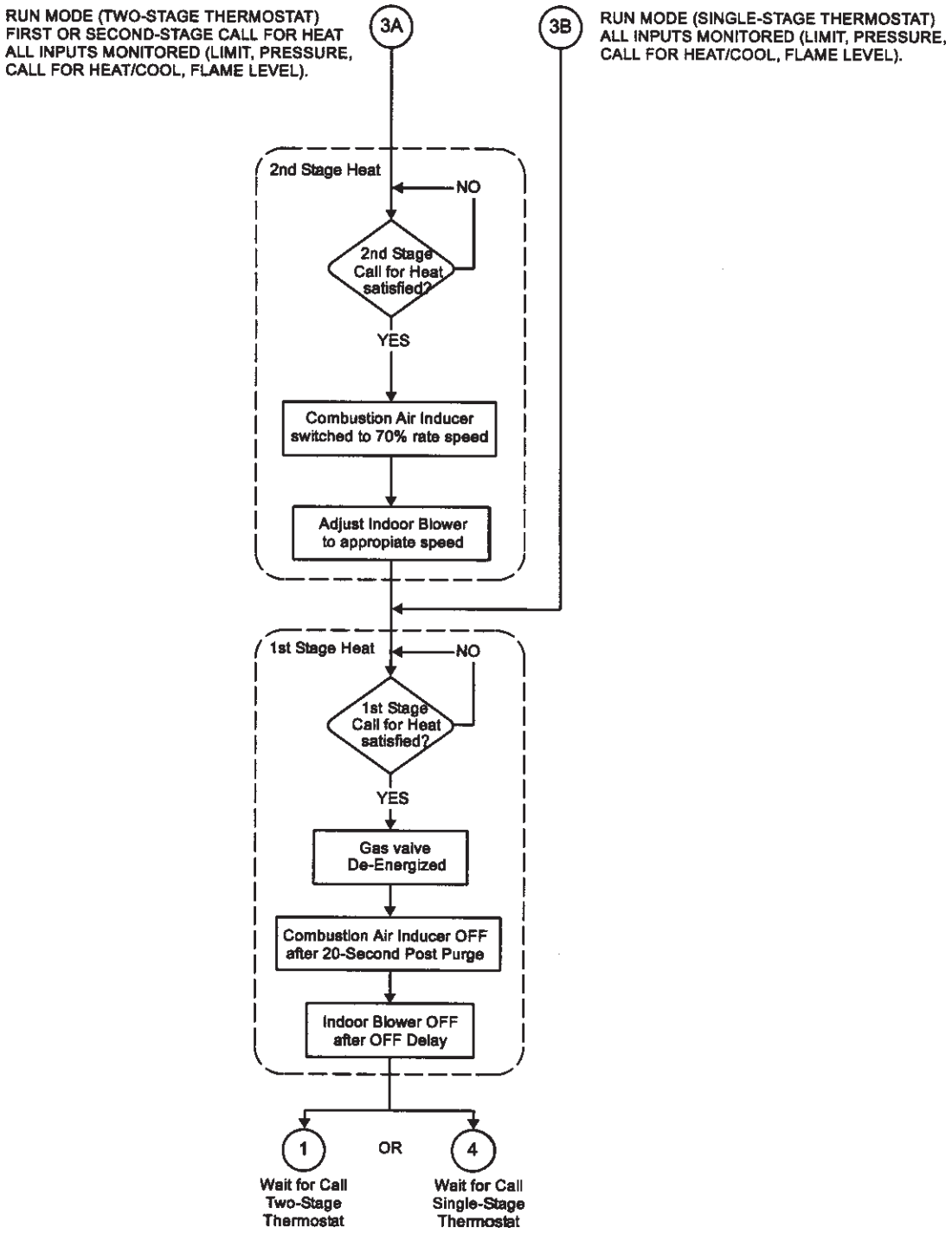
Call for High Fire With Two Stage Thermostat

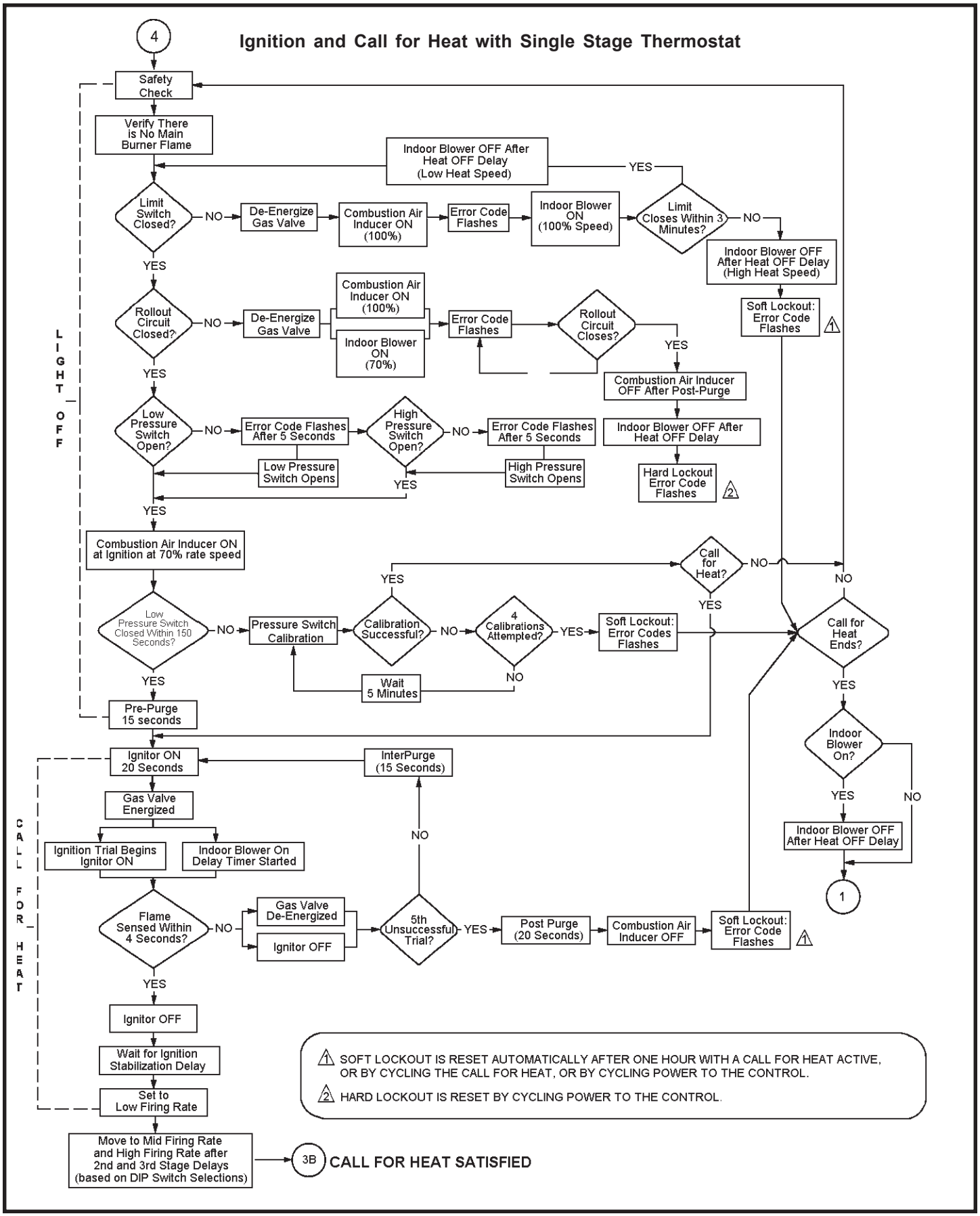


1 System will always light at 70% even if 2nd stage call for heat is in place

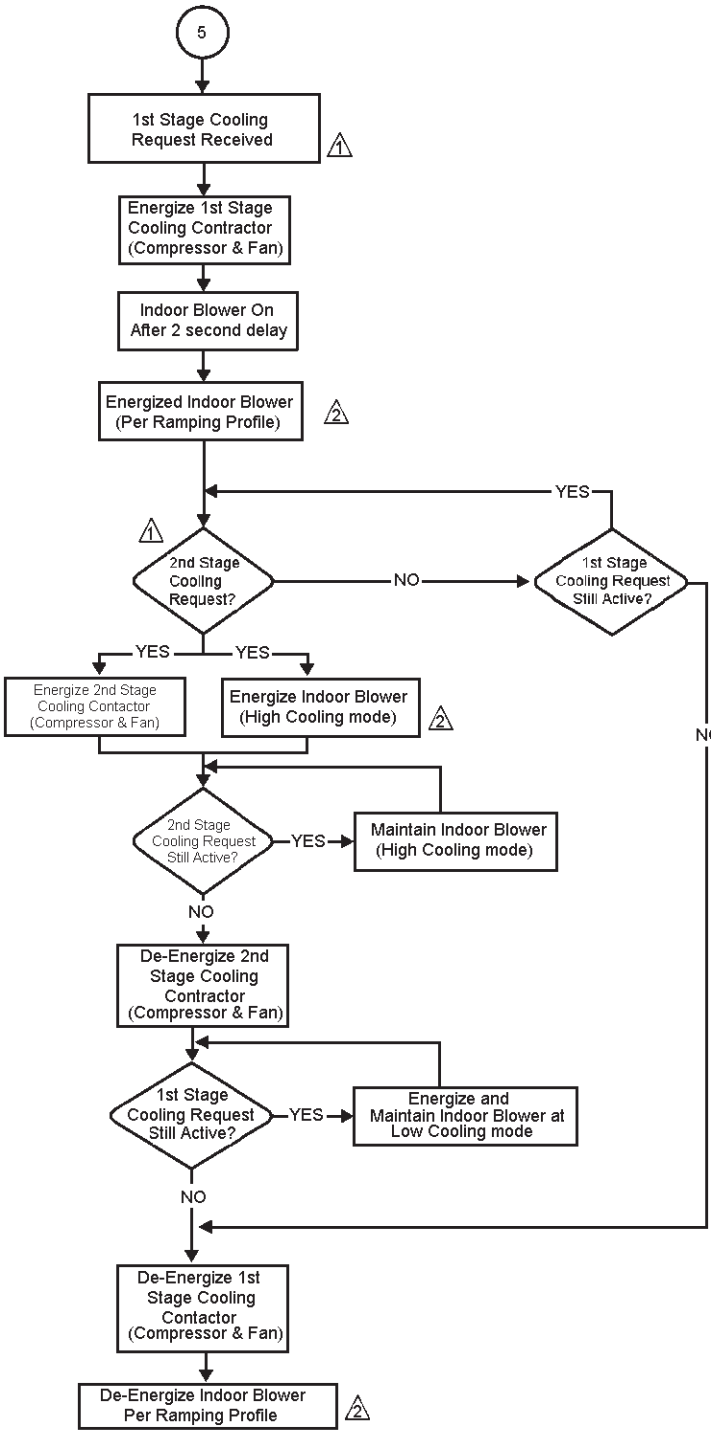
2 If the high pressure switch does not close within 5 attempts, the system will operate at low fire for the remainder of the call for heat at request

Call for Heat Satisfied


RUN MODE (TWO-STAGE THERMOSTAT) FIRST OR SECOND-STAGE CALL FOR HEAT ALL INPUTS MONITORED (LIMIT, PRESSURE, CALL FOR HEAT/COOL, FLAME LEVEL).
3A
3B
RUN MODE (SINGLE-STAGE THERMOSTAT) ALL INPUTS MONITORED (LIMIT, PRESSURE, CALL FOR HEAT/COOL, FLAME LEVEL).
2nd Stage Heat
NO
2nd Stage Call for Heat satisfied?
YES
Combustion Air Inducer switched to 70% rate speed
Adjust Indoor Blower to appropiate speed
1st Stage Heat
NO
1st Stage Call for Heat satisfied?
YES
Gas valve De-Energized
Combustion Air Inducer OFF after 20-Second Post Purge
Indoor Blower OFF after OFF Delay
1
OR
4
Wait for Call Two-Stage Thermostat
Wait for Call Single-Stage Thermostat


4
Ignition and Call for Heat with Single Stage Thermostat
Safety Check
Verify There is No Main Burner Flame
Indoor Blower OFF After Heat OFF Delay (Low Heat Speed)
YES
Limit Switch Closed?
NO
De-Energize Gas Valve
Combustion Air Inducer ON (100%)
Error Code Flashes
Indoor Blower ON (100% Speed)
Limit Closes Within 3 Minutes?
NO
Indoor Blower OFF After Heat OFF Delay (High Heat Speed)
Soft Lockout: Error Code Flashes
1
YES
Rollout Circuit Closed?
NO
De-Energize Gas Valve
Combustion Air Inducer ON (100%)
Indoor Blower ON (70%)
Error Code Flashes
Rollout Circuit Closes?
YES
Combustion Air Inducer OFF After Post-Purge
YES
Low Pressure Switch Open?
NO
Error Code Flashes After 5 Seconds
Low Pressure Switch Opens
High Pressure Switch Open?
NO
Error Code Flashes After 5 Seconds
High Pressure Switch Opens
YES
Indoor Blower OFF After Heat OFF Delay
Hard Lockout Error Code Flashes
2
YES
Combustion Air Inducer ON at Ignition at 70% rate speed
Call for Heat?
NO
YES
NO
YES
Low Pressure Switch Closed Within 150 Seconds?
NO
Pressure Switch Calibration
Calibration Successful?
NO
4 Calibrations Attempted?
YES
Soft Lockout: Error Codes Flashes
Call for Heat Ends?
YES
NO
Wait 5 Minutes
YES
Pre-Purge 15 seconds
Indoor Blower On?
YES
NO
Indoor Blower OFF After Heat OFF Delay
1
Ignitor ON 20 Seconds
InterPurge (15 Seconds)
Gas Valve Energized
Ignition Trial Begins Ignitor ON
Indoor Blower On Delay Timer Started
NO
Flame Sensed Within 4 Seconds?
NO
Gas Valve De-Energized
Ignitor OFF
5th Unsuccessful Trial?
YES
Post Purge (20 Seconds)
Combustion Air Inducer OFF
Soft Lockout: Error Code Flashes
1
YES
Ignitor OFF
Wait for Ignition Stabilization Delay
Set to Low Firing Rate
Move to Mid Firing Rate and High Firing Rate after 2nd and 3rd Stage Delays (based on DIP Switch Selections)
3B
CALL FOR HEAT SATISFIED
LIGHT OFF
CALL FOR HEAT
1 SOFT LOCKOUT IS RESET AUTOMATICALLY AFTER ONE HOUR WITH A CALL FOR HEAT ACTIVE, OR BY CYCLING THE CALL FOR HEAT, OR BY CYCLING POWER TO THE CONTROL.
2 HARD LOCKOUT IS RESET BY CYCLING POWER TO THE CONTROL.

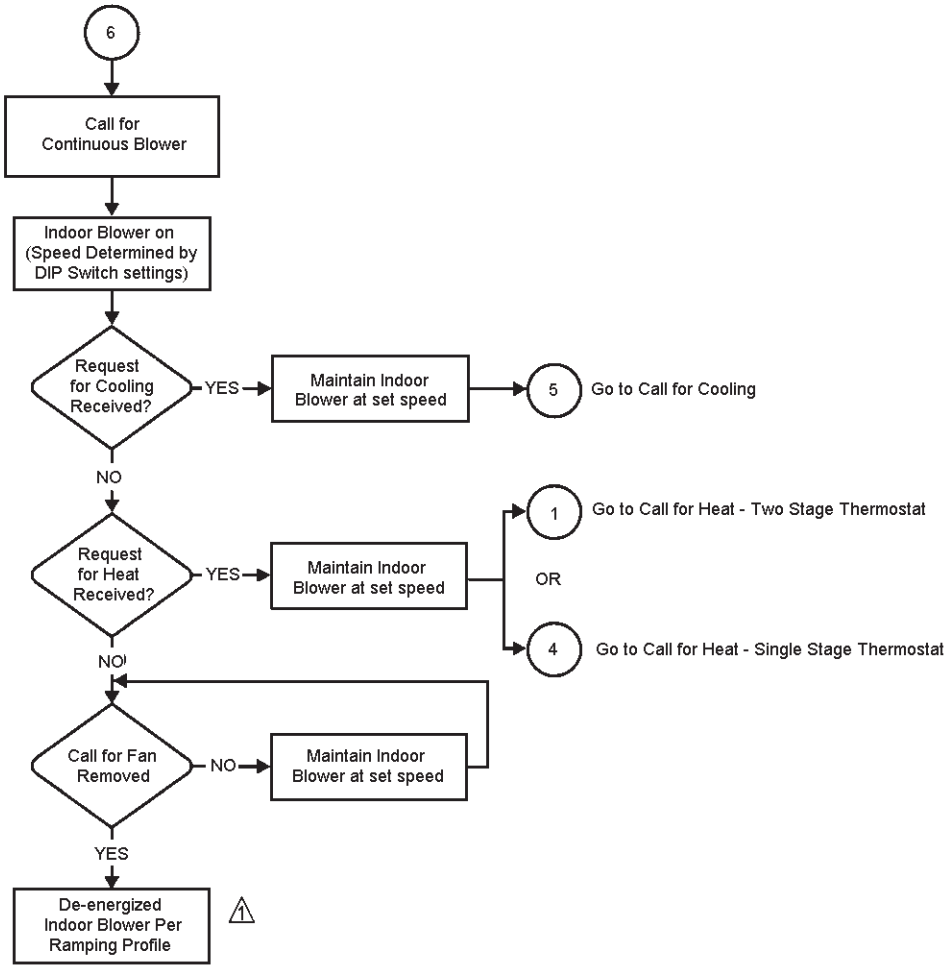
Call for Cooling



1 2nd stage cooling operation requires a 2 stage thermostat, a 2 stage cooling system and on board link W915 must be cut. The control will not respond to a 2nd stage cooling request unless a 1st stage cooling request is active.

2 Indoor blower cooling mode and high cooling mode have a specific ON, OFF and speed ramping profiles. The specific profile is selected using the DIP switches on the control.

Continuous Low Speed Indoor Blower Sequence of Operation



1 Indoor blower low cooling mode and high cooling mode, have specific ON - OFF and speed ramping profiles. The specifice profile is selected using the DIP switches on the control.

REPAIR PARTS LIST

The following repair parts are available through Allied Air distributors. When ordering parts, include the complete furnace model number listed on the nameplate. **All service must be performed by a licensed professional installer (or equivalent), service agency, or gas supplier.**

Cabinet Parts

- Heating Compartment Access Panel
- Blower Access Panel
- Top Cap

Control Panel Parts

- Transformer
- Integrated Control Board
- Door Interlock Switch
- Circuit Breaker

Blower Parts

- Blower Wheel
- Motor
- Motor Mounting Frame
- Blower Housing Cut Off Plate
- Power Choke (1 HP only)

Heating Parts

- Flame Sensor
- Heat Exchanger Assembly
- Gas Manifold
- Combustion Air Inducer
- Gas Valve
- Main Burner Cluster
- Main Burner Orifices
- Pressure Switch
- Ignitor
- Primary Limit Control
- Flame Rollout Switches

REQUIREMENTS for COMMONWEALTH of MASSACHUSETTS

Modifications to NFPA-54, Chapter 10

Revise NFPA-54 section 10.8.3 to add the following requirements:

For all side wall, horizontally vented, gas-fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above the finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

1. **INSTALLATION OF CARBON MONOXIDE DETECTORS.** At the time of installation of the side wall, horizontally vented, gas-fueled equipment, the installing plumber or gas fitter shall observe that a hard-wired carbon monoxide detector with an alarm and battery backup is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gas fitter shall observe that a battery-operated or hard-wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall, horizontally vented, gas-fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard-wired carbon monoxide detectors.
   a. In the event that the side wall, horizontally vented, gas-fueled equipment is installed in a crawl space or an attic, the hard-wired carbon monoxide detector with alarm and battery backup may be installed on the next adjacent floor level.
   b. In the event that the requirements of this subdivision cannot be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery-operated carbon monoxide detector with an alarm shall be installed.
2. **APPROVED CARBON MONOXIDE DETECTORS.** Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
3. **SIGNAGE**. A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented, gas-fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, **"GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS."**
4. INSPECTION. The state or local gas inspector of the side wall, horizontally vented, gas-fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a) 1 through 4.

EXEMPTIONS: The following equipment is exempt from 24 CMR 5.08(2)(a) 1 through 4:

1. The equipment listed in Chapter 10 entitled "Equipment Not Required to Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and
2. Product Approved side wall, horizontally vented, gas-fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.

MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM PROVIDED.

When the manufacturer of Product Approved side wall, horizontally vented, gas-fueled equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

1. Detailed instructions for the installation of the venting system design or the venting system components: and
2. A complete parts list for the venting system design or venting system.

MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED.

When the manufacturer of Product Approved sidewall, horizontally vented, gas-fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems," the following requirements shall be satisfied by the manufacturer:

1. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and
2. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.

A copy of all installation instructions for all Product Approved side wall, horizontally vented, gas-fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.